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AMPLAN
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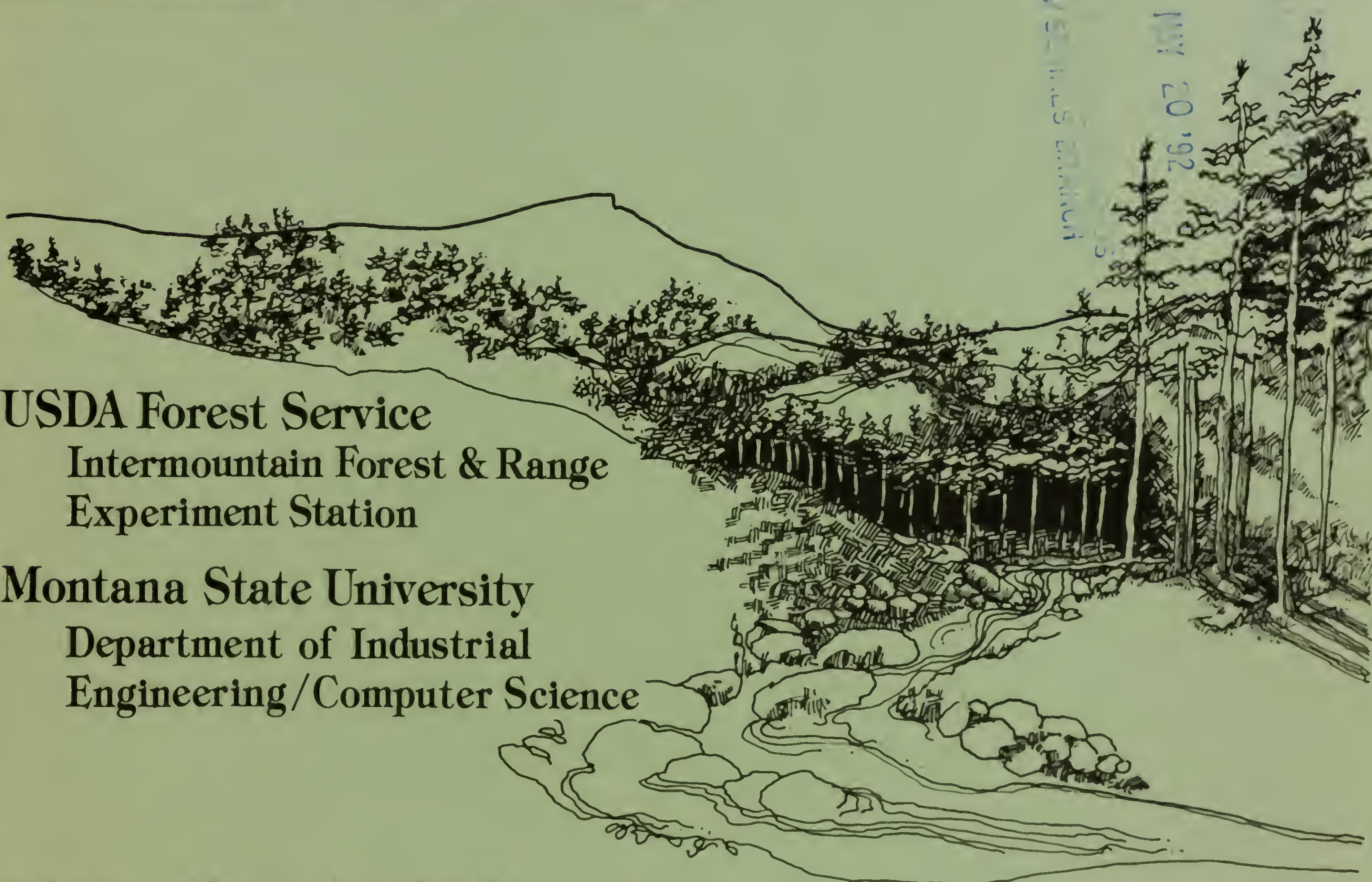
USERS' MANUAL



USDA Forest Service

Intermountain Forest & Range
Experiment Station

Montana State University

Department of Industrial
Engineering/Computer Science

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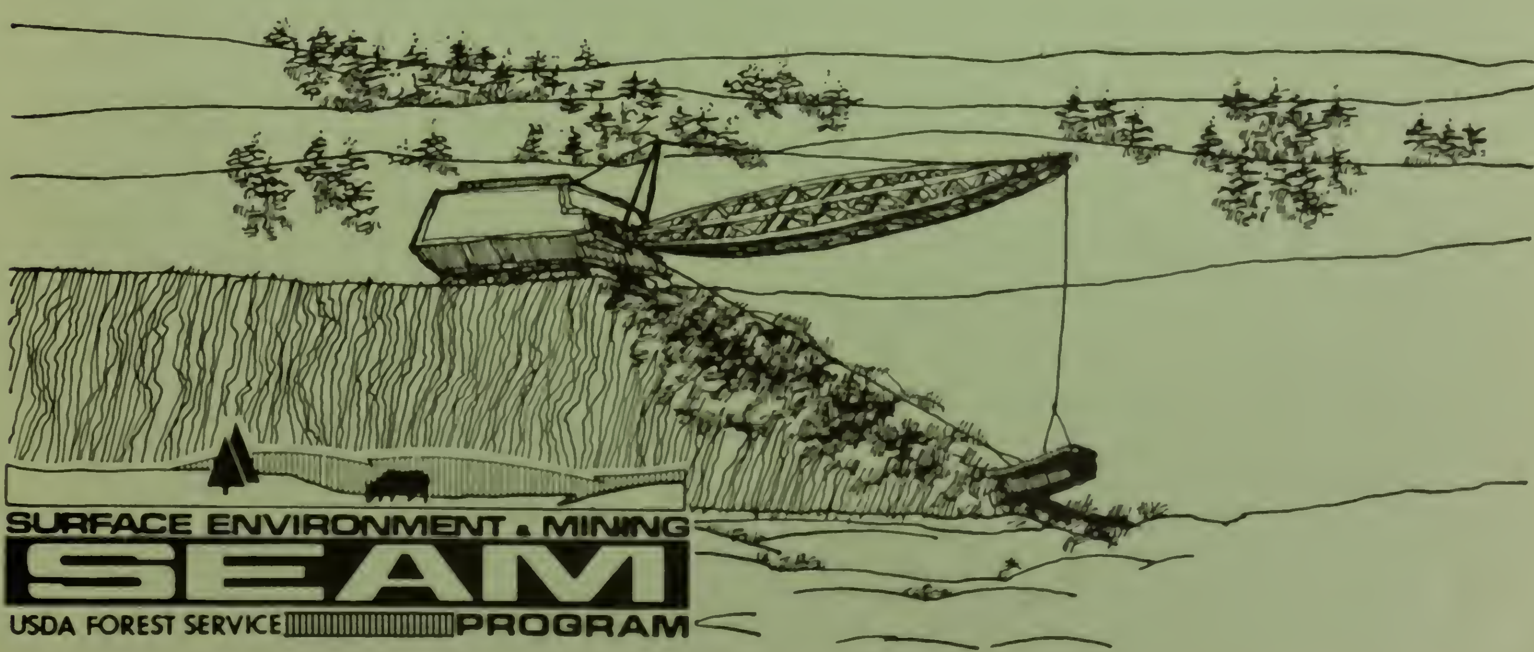

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CLAIM

Computerized Reclamation Planning System for Northern Great Plains Surface Coal Mines

USER'S MANUAL

January, 1980

Prepared by

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for

USDA Forest Service
Intermountain Forest and Range Experiment Station
Surface Environment and Mining (SEAM) Program

Montana State University, Cooperating

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I. INTRODUCTION - WHAT WILL CLAIM DO, AND FOR WHOM?

A. What it does

The CLAIM computerized reclamation planning system is designed to use a computer to make many of the same calculations that a land manager would make in preparing a reclamation plan for a surface coal mine. The advantages CLAIM offers over doing the same task by hand are the same advantages a computer offers to any complex human undertaking. These are: a) it increases the speed of the operation; b) it increases the objectivity of the analysis; c) it increases the accuracy of the analysis; and, d) it decreases the cost of the analysis.

The CLAIM system reviews over 75 operational and site input data (see the CLAIM User's Databook for a list of these data) and produces four main outputs for the user. These are:

1. Environmental feasibility ranking (FEASI). This routine ranks five major land use options according to how feasible it would be to reclaim for them after mining is finished (see Fig. 1). The land use options are: cropland, native vegetation (primarily rangeland), wildlife management, outdoor recreation (water-based), and high use (building site for homes or businesses). A sixth, optional, land-use may be entered in the system by the user, and this "other" use will be ranked along with the 5 major land uses.

2. Reclamation techniques and cost list (TECON). This routine produces a list of the specific reclamation techniques that should be used to reclaim a particular site back to each of the 5 major land uses (Fig. 2). Additionally, TECON calculates the cost of implementing each technique, and determines the grand total cost per acre for reclamation.

3. Optimum land use ranking (OPUSE). If the user desires a single ranking of the land uses from best to poorest, the OPUSE routine will provide this (Fig. 3). OPUSE ranks those land uses highest that have the best combination of low cost and high feasibility.

4. Spoils grading calculations (GRADE). The GRADE routines allow the user to independently calculate earthmoving volumes and costs for grading raw spoils down to any desired final topography. GRADE works for both dragline and truck and shovel-type mines, and can use graphics to depict the user's data (Fig. 4).

```
1  NUGO FILE ** TYPICAL NORTHERN GREAT PLAINS RANGELAND SITE

              FEASIBILITY INDEXES FOR THE CURRENT DATA
              ----------------------------------------

                1) NATIVE VEGETATION          2.186
                2) WILDLIFE                   2.099
                3) WATER-BASED RECREATION     2.062
                4) HIGH-USE                   1.998
                5) CROPLAND                   1.899
                6) OTHER                       .001


=====================================================================

HIT THE RETURN KEY TO CONTINUE :
```

Figure 1. Example of Environmental Feasibility (FEASI) output of CLAIM.

```
NVGO FILE ** TYPICAL NORTHERN GREAT PLAINS RANGELAND SITE

     *** CROPLAND ALTERNATIVE ***

          TECHNIQUE                            COST/ACRE
          ---------                            ---------
 1)STRIP ALL TOPSOIL                           $   887.33
 2)RESPREAD ALL TOPSOIL                        $   665.50
 3)STRIP 1 FOOT OF SUBSOIL                     $   968.00
 4)RESPREAD 1 FOOT OF SUBSOIL                  $   726.00
 5)GRADE SPOIL                                 $  1231.31
 6)CHISEL PLOW                                 $    10.50
 7)DISC AND HARROW                             $     3.75
 8)BUY SEED                                    $     4.00
 9)DRILL SEED                                  $     3.75
10)BUY FERTILIZER : NITROGEN                   $     9.00
11)BUY FERTILIZER : PHOSPHATE                  $     7.00
12)DRILL FERTILIZER                            $     1.00
13)BUY HAY MULCH                               $    37.50
14)APPLY HAY MULCH                             $    30.00
15)BUY,APPLY HERBICIDE                         $     2.75
16)ERECT ANIMAL FENCING                        $    40.00
17)STABILIZE TOPSOIL STORAGE PILE              $    10.92
18)ADMIN. OF OPERATIONS AND NECESSARY TESTS    $   695.75

                                               =========
                                     TOTAL     $   5334.07

GRAND TOTAL COST FOR   300.0 ACRES IS          1.60 MILLION DOLLARS
```

Figure 2. Sample output of the CLAIM system for reclamation techniques and costs (TECON).

1 TEST RUN

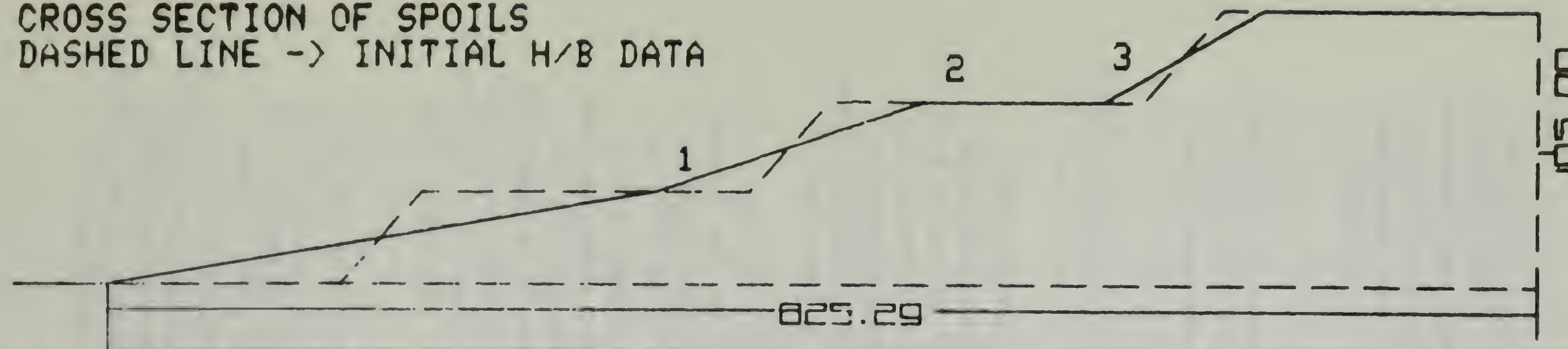
*** COMPARISONS AND OPTIMUM USE FACTORS ***

FEASIBILITY RANKING		COST PER ACRE		OPTIMUM USE	
1). NAT.VEG.	2.186	1). WILDLIFE	4435.46	1). NAT.VEG.	.48716
2). WILDLIFE	2.099	2). NAT.VEG.	4486.35	2). WILDLIFE	.47313
3). WAT.REC.	2.062	3). WAT.REC.	5039.25	3). WAT.REC.	.40928
4). HIGH USE	1.998	4). CROPLAND	5334.07	4). HIGH USE	.36398
5). CROPLAND	1.899	5). HIGH USE	5490.34	5). CROPLAND	.35598

HIT THE RETURN KEY TO CONTINUE :

Figure 3. Sample optimum use ranking, with feasibility and cost summaries.

CROSS SECTION OF SPOILS
DASHED LINE -> INITIAL H/B DATA



H/B NO.	HW SLOPES-DEG INITIAL:FINAL	BENCHES (FT) INITIAL:FINAL	HW HGT (FEET)	BEN LEN (FEET)	VOL GRADED (CU YDS)	COST
1	34.0: 5.7	209.5: .0	35.0	3566.5	110713.7	21035.61
2	34.0: 11.5	200.0: 115.0	35.0	2259.5	51971.6	9874.60
3	34.0: 19.0	200.0: 175.1	35.0	1000.0	10658.2	2025.06
				TOTALS:	173343.5	32935.27

```
REHANDLE VOLUME :    100000.00 CUBIC YARDS
REHANDLE COST   :        65.00 CENTS PER CUBIC YARD
REHANDLE TOTAL  :     65000.00 DOLLARS

AREA COVERED BY GRADED SPOILS :        48.01 ACRES
REHANDLE COST PER ACRE        :      1353.89 DOLLARS
GRADING COST PER ACRE         :       686.01 DOLLARS
 ***** GRAND TOTAL COST PER ACRE IS     2039.90 DOLLARS *****
PLOTTER COPY ? (YES OR NO) ->NO
```

Figure 4. Sample graphic output of GRADE for a truck and shovel mining operation.

B. Who may use CLAIM

The CLAIM, FEASI, TECON, and OPUSE routines are designed for environmental conditions in the coalfields of the Northern Great Plains--a 63 county area in eastern Montana, northeastern Wyoming, northwestern South Dakota, and western North Dakota. Consequently, land managers in this region will be the prime CLAIM users, although plans have been made to expand the system to cover other coal fields in the western and eastern United States.

The GRADE subsystem within CLAIM will operate anywhere in the world where coal or other surface mining is done with a dragline or a truck and shovel operation on non-dipping seams. It also can be adapted to work with bucketwheel excavators.

Whatever the region, there are 3 main kinds of users for which CLAIM is designed:

1. Government land managers. This includes professional land managers in agencies such as the U.S. Forest Service, Bureau of Land Management, Fish and Wildlife Services, etc. who are not normally trained in mining or reclamation engineering, but who must read and evaluate reclamation plans when the mine affects Federal surface or minerals under the agency's jurisdiction. The system is designed to make reclamation "experts" out of these people so they may conduct a competent, timely evaluation of reclamation and final land-use plans.

2. Government regulatory agencies. Agencies such as the federal Office of Surface Mining, Montana Department of State Lands, Wyoming Department of Environmental Quality, and North Dakota Public Service Commission are charged with reviewing and approving a company's prospective mining and reclamation plan. Additionally, these agencies must calculate a reasonable reclamation bond that must be obtained by the company. The CLAIM system allows such agencies to evaluate reclamation plans quickly and objectively, and the agency may even propose alternative final land uses. Also, the system provides for the setting of a bonding amount in an objective manner, while bypassing tedious, expensive hand calculations.

3. Coal mine reclamation managers. The CLAIM system allows the mine reclamation manager to maximize the efficiency of his planning by allowing him to compare the costs of several reclamation plans for the same area in a matter of minutes. If and when the mine plan changes due to unforseen conditions, the reclamation manager can quickly develop a new reclamation plan, and calculate costs that will affect the overall selling price of the coal. By speeding up the planning process, the computer can help reduce planning costs. By reducing human error, CLAIM can also help avoid mistakes that may require costly regrading.

C. Versions of CLAIM

CLAIM exists in 2 versions - one that operates as a part of the SEAMPLAN system, and a stand-alone version. The SEAMPLAN version of CLAIM contains all of the basic data input and editing options, but operates only for dragline type mines because SEAMPLAN currently works only for this type of mine. Scheduling of CLAIM from SEAMPLAN is described in the SEAMPLAN User's Guide (Mooney et al. 1979a) and the SEAMPLAN Program Documentation (Mooney et al. 1979b). In this mode, mine plan data are "automatically" transferred to CLAIM, and CLAIM data are used in regression equation models to calculate costs for operating topsoil scrapers and bulldozers for grading. These costs, plus the overall reclamation costs, are then transferred from CLAIM back to the mine planning part of SEAMPLAN, where total costs of the venture are calculated at 3 different levels of accuracy.

When CLAIM is operated by itself--such as by a reclamation manager or government agency, the mine characteristics must be entered by hand (see User's Databook for these parameters). Since it is not linked to SEAMPLAN this way, this CLAIM version will also operate for truck and shovel mines. This manual describes the operation of the second, complete version of CLAIM, and includes the SEAMPLAN version.

II. COMPUTER HARDWARE NECESSARY TO OPERATE CLAIM

A. System on Which CLAIM was Developed

The first edition of CLAIM was developed from September, 1977 through March, 1980 on a Hewlett-Packard 21MX minicomputer system, on the Montana State University Campus. The main user interface with the system is through a Tektronix 4014-1, or a 4006-1 CRT terminal. The system includes a digital tape drive, paper tape drive, two disc drives, teletype, drum plotter, digitizing tablet, and line printer. This entire setup, and how it was selected, is well described in the SEAMPLAN Overview (Mooney et al. 1979). The minicomputer system allows faster turnaround time and lower cost of operation, but requires a higher initial investment ($100,000), than a large, time-shared computer system.

B. Computer Hardware Needed by the User

If the user can obtain the same brands of computer and peripheral devices as described in the SEAMPLAN overview, CLAIM can be run immediately and with no changes, once the program tape is obtained from Montana State University.

If the user plans to utilize a different kind of computer, certain machine-dependent commands must be changed throughout the CLAIM program so the new computer can understand them. Also, because the H-P mini-computer has a relatively small core memory, many subroutines in CLAIM must be "swapped" on and off a disc storage device, since the core can not physically hold all of them at once. Most of the swapping commands are localized in one unit, so they may be deleted or changed readily. The user should have access to a competent programmer to make and "debug" these changes so that CLAIM operates on his own computer. A programmer should be able to make the system changes in about a month, after referring to the CLAIM Programmer's Manual and Program Listing.

Once the CLAIM system is operating on a computer, the user interacts with it through a terminal. If the user wishes to operate the CLAIM system with its graphics capabilities, he should obtain a Tektronix CRT terminal. This is recommended because the graphics routines are programmed to operate on this brand of terminal. If the user elects to use another brand of CRT, it will require much reprogramming. CLAIM will operate on the smaller, relatively inexpensive, Tektronix 4006-1, or on the larger, costlier, 4014-1, which has other capabilities needed by SEAMPLAN, but not by CLAIM. Several other Tektronix CRT models also will handle the CLAIM system.

If the user does not wish to use the CLAIM graphics routines, or does not wish to invest in a CRT terminal, he can also operate CLAIM on a standard Teletype-sort of machine, or a raster-scan type terminal. These are relatively inexpensive and readily available in many offices. This kind of terminal will print out all of the final results of FEASI, TECON, OPUSE, and GRADE, but can not depict the graphics parts of GRADE.

C. Operating the Terminal Interactively

The CLAIM reclamation planning system is interactive with the user. This means, basically, that the computer has been programmed to ask the user questions, via the terminal. When the user answers the questions, the computer automatically proceeds to the next step, or quits, as instructed by the user.

To initiate the operation of CLAIM, the user performs several "start up" steps which are peculiar to his brand of hardware. For the Hewlett-Packard-Tektronix equipment, the following are done:

1. Turn on the computer, terminal, line printer, large disc, teletype.

2. At the prompt "09" on the terminal's screen, type in RU,FMG then press the terminal's carriage return button.

3. When the prompt ":" appears, type in MC,15 then hit the return.

4. When the prompt ":" appears again, type in RU,CLAIM and hit the return.

5. The CLAIM system will start operating - which will be discussed in detail in the next section. At this beginning point, the user should remember to answer any question appearing on the screen with the appropriate number or letter within the range specified, and then always, press the return button. If the user answers with a letter when it should have been a number, or answers out of the proper range (like hitting a "6" when only 0-5 are possible), he will get an "error message" from the computer, and will be asked to re-enter his answer. These messages are designed to insure that only reasonable data are entered in the system, and they also help the user to keep from getting "lost in a loop" somewhere in the computer - never to return. Figure 5 is an example of such an error message.

III. OPERATING CLAIM - THINGS TO EXPECT

The following pages will show the user examples of what kinds of options are offered by the CLAIM system in achieving the final 4 major outputs described earlier. Also, reasons for the appearance of certain limitations to the range of data that can be input are provided. Usually these limitations are based on legal constraints, as mandated by the Federal Surface Mining Control and Reclamation Act of 1977 and its pursuant regulations. However, financial practicalities and mathematical rules also prescribe some limits.

The best way to become familiar with the operation of CLAIM is to simply turn on the equipment, answer questions, and see what results. This manual's figures are copies of actual CLAIM material appearing on a CRT terminal. The user should operate the system to see if he gets the same results as presented here.

After the user types in RU,CLAIM, the computer will ask whether he is using a CRT (Fig. 6). If he answers "no", all display of graphics will be bypassed, since a teletype cannot draw figures. If the user is using a CRT, a "no" answer will prevent normal paging, and the user should start over with "yes". After this, a pause occurs while the computer searches for files on the disc storage device. When found, these files will then initiate the operation of the CLAIM programs. During this wait, the system title and brief messages will appear on the screen (Fig. 7). Once files are initialized, the CLAIM executive appears which shows all the basic ways that raw data may be manipulated (see Fig. 8). These options will be discussed in step-by-step fashion from here on.

```
                  EDIT RESPONSES/GENERAL DESCRIPTION

I.) GENERAL DESCRIPTION:   ********************************************
                           *          STANDARD EXPECTATIONS           *
                           ********************************************
                           *CROP*  NATIVE   *WILD*  WATER    *HIGH*OTHER*
                           *LAND*VEGETATION*LIFE*RECREATION*USE *     *
***********************************************************************
                           *    *          *    *          *    *     *
 A.) TYPE OF MINE :        *    *          *    *          *    *     *
  1.) DRAGLINE             *  2 *    2     *  2 *    2     * 2  *  0  *
  2.) TRUCK AND SHOVEL     *  2 *    2     *  2 *    2     * 2  *  0  *
     YOUR CURRENT RESPONSE IS -> 1

     ENTER YOUR NEW RESPONSE HERE -> 3
YOU HAVE TYPED IN AN ILLEGAL ANSWER.
GIVE HER ANOTHER SHOT

ENTER THE APPROPRIATE      ********************************************
NUMBER, OR ZERO TO QUIT ->
```

Figure 5. Sample error message for inappropriate answer.

```
:MC,15
 :RU,CLAIM
  ARE YOU USING A CRT TERMINAL WITH ERASE
  CAPABILITY ? (YES OR NO) -> YES
```

Figure 6. CLAIM question as to what type of terminal is being used.

```
******************************
*                            *
*           CLAIM            *
*                            *
*  COMPUTERIZED RECLAMATION  *
*      PLANNING SYSTEM       *
*                            *
******************************

HELLO. I'LL NEED A FEW SECONDS TO GET ORGANIZED...

JUST A FEW SECONDS MORE....
```

Figure 7. Messages that appear during the CLAIM file initialization process.

```
******************************
*                            *
*           CLAIM            *
*                            *
*  COMPUTERIZED RECLAMATION  *
*      PLANNING SYSTEM       *
*                            *
******************************

---------
 OPTIONS
---------

0 -> TERMINATE CLAIM

1 -> DATA INPUT

2 -> DATA EDIT

3 -> CURRENT DATA REVIEW

4 -> DATA STORAGE

5 -> DATA ANALYSIS

6 -> GRADE SPOILS ONLY

ENTER OPTION SELECTION ->
```

Figure 8. CLAIM executive showing all major ways data may be manipulated.

A. Terminate (CLAIM Executive option 0)

By hitting the 0 the user tells the computer to stop running the CLAIM program.

B. Data Input (CLAIM Executive option 1)

The user is offered many ways to input data to CLAIM. After hitting 1, the data input options are shown (Fig. 9). This is the data input executive.

0. The "0" command returns the user to the CLAIM executive.

1. The "1" response allows the user to manually input data just describing the basic characteristics of the mine. (These data are input automatically when CLAIM is operated as part of SEAMPLAN.)

Both the type of mine (Fig. 10) and the stage in the mining sequence (Fig. 11) are input by the user. These answers result in greatly different spoils grading requirements, and these, in turn, greatly affect many of the other CLAIM reclamation costs. Therefore, these grading inputs will be discussed in detail here.

a. Dragline type mines - mine run

Typical input data for the dragline mine run spoils are shown in Fig. 12. These data may be edited (Fig. 13) then, once basic mine characteristics are described, the computer offers the user a chance to look at graphs which will show the relationship between how flat an area is graded and how much volume of spoil will be moved and how much the grading will cost (Figs. 14, 15). The user can look at certain parts of the graphic relationship in more detail, if he desires (Figs. 16, 17) and can even get a tabular summary of what was graphed (Fig. 18). For all graphs and tables, the computer records what the desired slope interval is, then divides this into 10 equal parts--which accounts for the values on the y axis.

After the user has looked at graphs and tables of his basic cost relationships, the computer presents a list of default topography mixes for each of the 5 main land use options (Fig. 19). There were three main reasons for providing this list:

1) These mixtures offer practical, suitable slopes for each land use option. Overall, the slope mixes range from flattest to hilliest in the following order:

```
*****************************
*                           *
*           CLAIM           *
*                           *
*  COMPUTERIZED RECLAMATION *
*      PLANNING SYSTEM      *
*                           *
*****************************

------------
 DATA INPUT
------------

0 -> EXIT FROM DATA INPUT OPTION

1 -> MANUAL INPUT OF THE GENERAL MINE DESCRIPTION

2 -> FILE INPUT OF THE GENERAL MINE DESCRIPTION

3 -> MANUAL INPUT OF ENVIRONMENTAL DATA

4 -> FILE INPUT OF ENVIRONMENTAL DATA

5 -> FILE INPUT OF BOTH ENVIRONMENTAL DATA
     AND GENERAL MINE DESCRIPTION

6 -> MANUAL INPUT OF NON-STANDARD EXPECTATION VALUES

7 -> FILE INPUT OF NON-STANDARD EXPECTATION VALUES

8 -> INPUT TITLE TO APPEAR ON ALL OUTPUT

ENTER YOUR SELECTION -> 1
```

Figure 9. Different options for data input to CLAIM.

```
                     INPUT RESPONSES/GENERAL DESCRIPTION

I.) GENERAL DESCRIPTION:  *********************************************
                          *              STANDARD EXPECTATIONS        *
                          *********************************************
                          *CROP*  NATIVE   *WILD*  WATER    *HIGH*OTHER*
                          *LAND*VEGETATION*LIFE*RECREATION*USE *     *
*************************************************************************
                          *    *          *    *          *    *     *
 A.) TYPE OF MINE :       *    *          *    *          *    *     *
  1.) DRAGLINE            *  2 *     2    *  2 *     2    * 2  *  0  *
  2.) TRUCK AND SHOVEL    *  2 *     2    *  2 *     2    * 2  *  0  *
ENTER THE APPROPRIATE     *********************************************
NUMBER, OR ZERO TO QUIT -> 1

AVERAGE COST TO EXCAVATE SPOIL (CENTS/CU.YD.)-> 23
```

Figure 10. User input as to type of mine and cost to excavate spoil.

```
I.) GENERAL DESCRIPTION:  *********************************************
                          *             STANDARD EXPECTATIONS          *
                          **********************************************
                          *CROP*  NATIVE  *WILD*  WATER   *HIGH*OTHER*
                          *LAND*VEGETATION*LIFE*RECREATION*USE *     *
*********************************************************************
                          *    *          *    *          *    *     *
 B.) STAGE IN MINING      *    *          *    *          *    *     *
     SEQUENCE :           *    *          *    *          *    *     *
  1.) OPENING BOX CUT     * 1  *    1     * 2  *    1     * 1  *  0  *
  2.) MINE RUN            * 2  *    2     * 2  *    2     * 2  *  0  *
  3.) FINAL BOX CUT       * 1  *    1     * 3  *    3     * 1  *  0  *
ENTER THE APPROPRIATE     ********************************************
NUMBER, OR ZERO TO QUIT -> 1
*********************************************************************
                          *    *          *    *          *    *     *
 C.) AVERAGE SLOPE OF     *    *          *    *          *    *     *
     10 RANDOM POINTS     *    *          *    *          *    *     *
     IN THE AREA :        *    *          *    *          *    *     *
  1.)  0.00 - 3.00        * 3  *    2     * 2  *    2     * 3  *  0  *
  2.)  3.01 - 5.70        * 2  *    3     * 2  *    3     * 2  *  0  *
  3.)  5.71 - 11.50       * 0  *    2     * 3  *    2     * 1  *  0  *
ENTER THE APPROPRIATE     ********************************************
NUMBER, OR ZERO TO QUIT -> 1
```

Figure 11. Stage in the mining sequence, and slope of mine area.

```
--- DRAGLINE/MINE RUN ---

AVERAGE DISTANCE BETWEEN SPOIL BANK PEAKS (FEET) -> 120

INITIAL AVERAGE SLOPE OF THE SPOIL BANKS (DEGREES) -> 34

TOTAL AREA COVERED BY THE SPOIL BANKS (ACRES) -> 300

AVERAGE SLOPE OF THE AREA PERPENDICULAR TO THE
SPOIL BANK AXIS (DEGREES) -> 1

COST OF GRADING SPOILS (CENTS/CU.YD) -> 25
```

Figure 12. Typical input data for dragline mine run spoils (large mine).

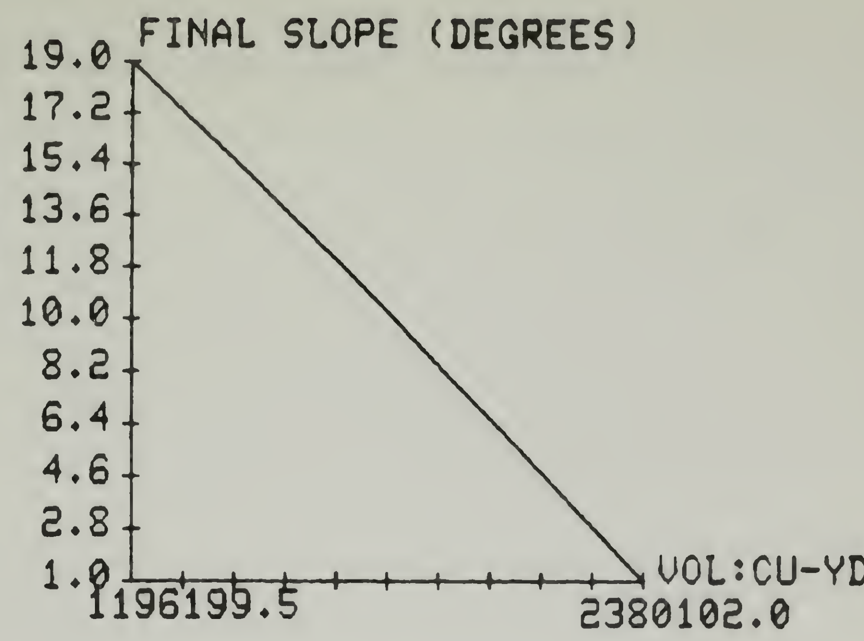
```
--- DRAGLINE/MINE RUN ---

   CURRENT VALUES FOR THE DATA ARE :
     1) AVERAGE DISTANCE BETWEEN SPOIL BANK PEAKS:   120.00 FEET
     2) INITIAL AVERAGE SLOPE OF THE SPOIL BANKS :    34.00 DEGREES
     3) TOTAL AREA COVERED BY THE SPOIL BANKS    :   300.00 ACRES
     4) AVERAGE SLOPE OF THE AREA PERPENDICULAR TO
        THE SPOIL BANK AXIS                      :     1.00 DEGREES
     5) COST OF GRADING SPOILS                   :    25.00 CENTS/CU.YD

 IF YOU WISH TO CHANGE ANY OF THE ABOVE VALUES, ENTER
 THE NUMBER CORRESPONDING TO THE ITEM YOU WANT TO CHANGE.
 IF NO CHANGES ARE DESIRED, ENTER A ZERO -> 0
```

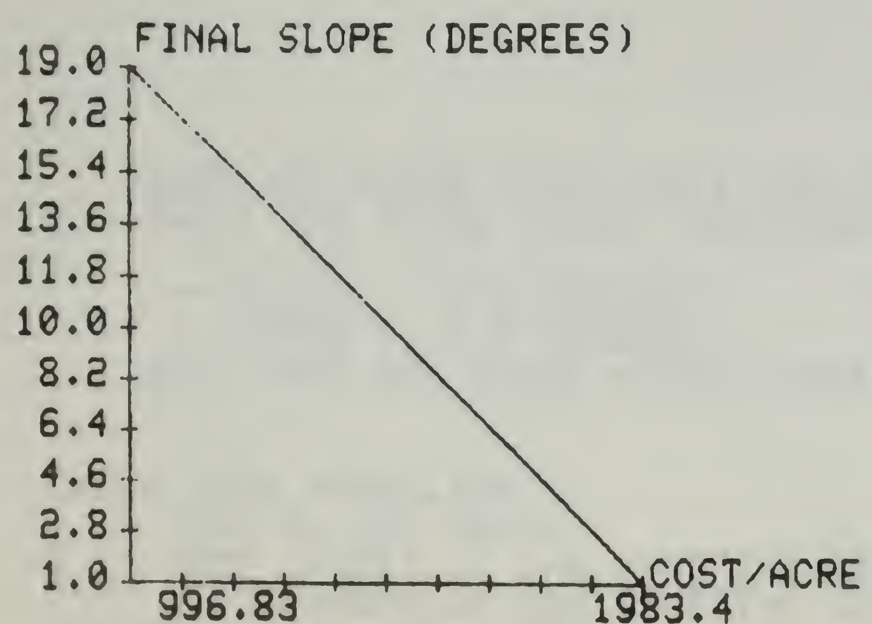
Figure 13. Current data review and edit option for dragline mine data.

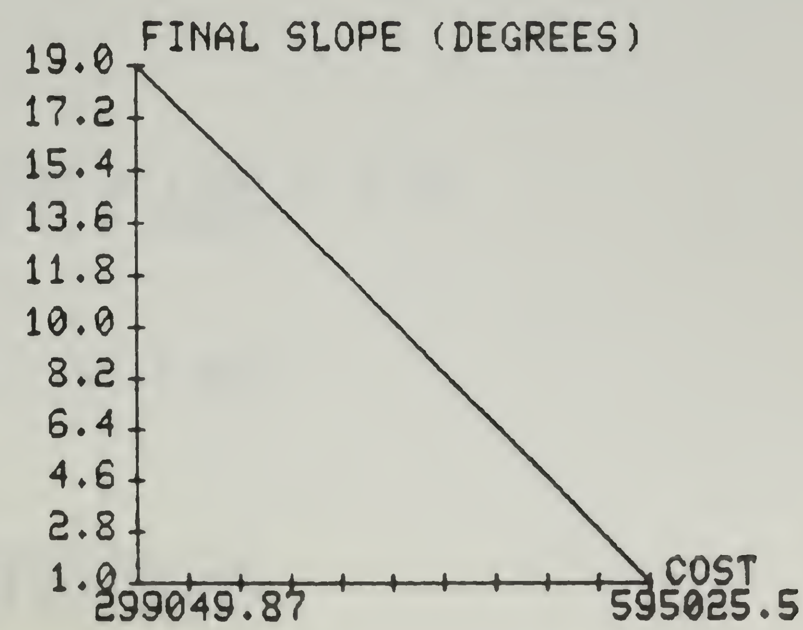
```
SELECT ONE OF THE FOLLOWING
1 -> VIEW GRAPHS OF THE DRAGLINE RELATIONSHIPS
2 -> VIEW TABLES OF THE DRAGLINE RELATIONSHIPS
0 -> NONE OF THE ABOVE
ENTER YOUR SELECTION -> 1


    THE LOWER AND UPPER FINAL SLOPE LIMITS ARE :
     -- LOWER =  1.0 DEGREES
     -- UPPER = 19.0 DEGREES

    INPUT THE LOWER LIMIT, FOLLOWED BY A COMMA,
    THEN THE UPPER LIMIT THAT YOU WISH TO VIEW -> 1,19
```

Figure 14. Options allowing user to look at grading cost-volume relationships.

```
** DRAGLINE - MINE RUN **

  CURRENT INPUT DATA:

DIST. BETWEEN SPOIL PEAKS : 120.00 FT
INITIAL SPOIL BANK SLOPE  :  34.00 DG
AREA COVERED BY SPOILS    : 300.00 AC
GENERAL SLOPE OF THE AREA :   1.00 DG
COST OF GRADING OVERBURDEN:25.00 C/CY
 HIT RETURN TO CONTINUE..
```







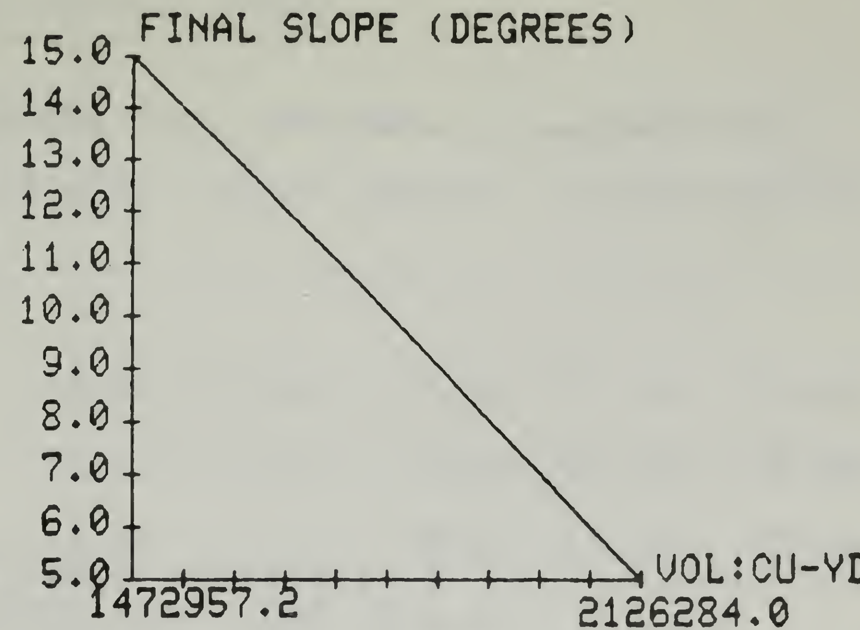
```
SELECT ONE OF THE FOLLOWING
1 -> VIEW GRAPHS OF THE DRAGLINE RELATIONSHIPS
2 -> VIEW TABLES OF THE DRAGLINE RELATIONSHIPS
0 -> NONE OF THE ABOVE
ENTER YOUR SELECTION -> 1

    THE LOWER AND UPPER FINAL SLOPE LIMITS ARE :
     -- LOWER =  1.0 DEGREES
     -- UPPER = 19.0 DEGREES

    INPUT THE LOWER LIMIT, FOLLOWED BY A COMMA,
    THEN THE UPPER LIMIT THAT YOU WISH TO VIEW -> 5,15
```

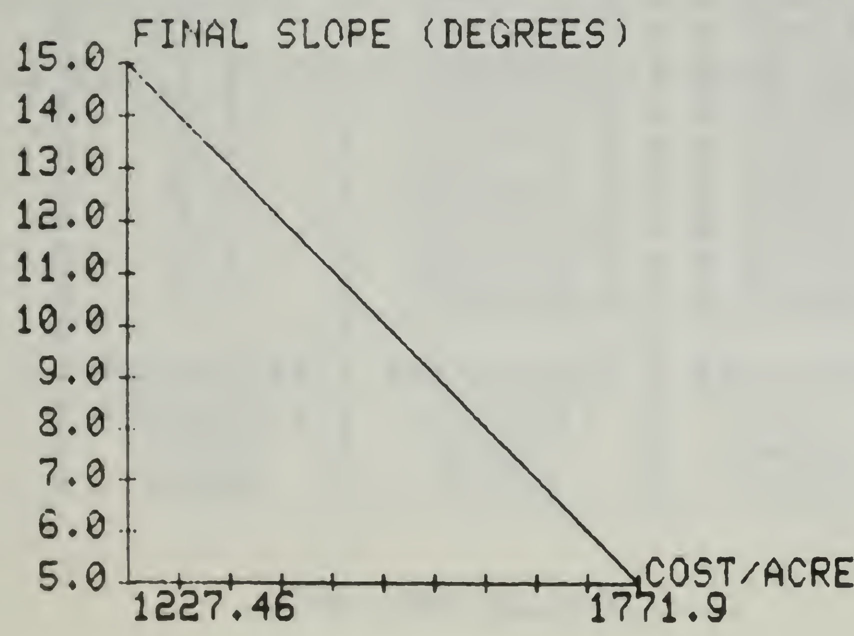
Figure 16. Selecting a narrower range of slopes to graph in more detail - dragline mine run spoils.

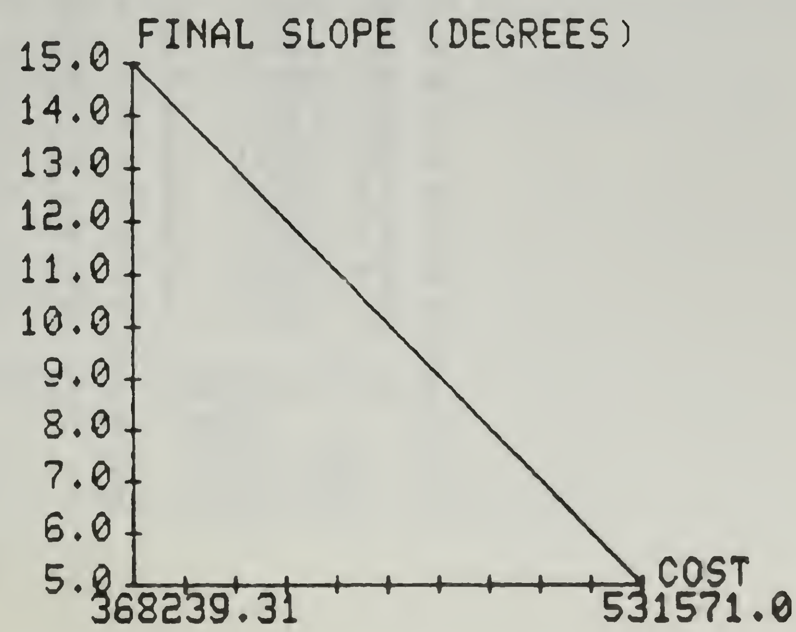
** DRAGLINE - MINE RUN **

CURRENT INPUT DATA:

```
DIST. BETWEEN SPOIL PEAKS : 120.00 FT
INITIAL SPOIL BANK SLOPE  :  34.00 DG
AREA COVERED BY SPOILS    : 300.00 AC
GENERAL SLOPE OF THE AREA :   1.00 DG
COST OF GRADING OVERBURDEN:25.00 C/CY
 HIT RETURN TO CONTINUE..
```







MINE RUN OPTION

FINAL SLOPE (DEGREES)	VOLUME MOVED (CU-YDS)	TOTAL GRADING COST	AVERAGE COST PER ACRE
1.0	2380102.0	$ 595025.50	$ 1983.42
2.8	2266108.0	$ 566527.00	$ 1888.42
4.6	2151764.0	$ 537941.00	$ 1793.14
6.4	2036841.2	$ 509210.31	$ 1697.37
8.2	1921107.5	$ 480276.87	$ 1600.92
10.0	1804321.0	$ 451080.25	$ 1503.60
11.8	1686234.7	$ 421558.69	$ 1405.20
13.6	1566589.0	$ 391647.25	$ 1305.49
15.4	1445112.2	$ 361278.06	$ 1204.26
17.2	1321515.5	$ 330378.87	$ 1101.26
19.0	1196199.5	$ 299049.87	$ 996.83

HIT RETURN TO CONTINUE.....

Figure 18. Tabular summary of dragline spoils grading cost-slope-volume relationships.

```
                    CURRENT SLOPE-PERCENT PAIRS
                    ===========================

   CROPLAND        NAT.VEG.       WILDLIFE       WAT.REC.       HIGH USE
SLOPE-PERCENT  SLOPE-PERCENT  SLOPE-PERCENT  SLOPE-PERCENT  SLOPE-PERCENT
-------------  -------------  -------------  -------------  -------------

01.00 - 50.00  01.00 - 25.00  01.00 - 10.00  01.00 - 25.00  01.00 - 50.00
05.70 - 50.00  05.70 - 25.00  05.70 - 25.00  05.70 - 25.00  05.70 - 25.00
      -        11.50 - 25.00  11.50 - 40.00  11.50 - 40.00  11.50 - 25.00
      -        19.00 - 25.00  19.00 - 25.00  19.00 - 10.00        -
=========================================================================

SELECT: 1=>PROCEED,2=>MODIFY SOME SLOPES,3=>RE-DEFINE ALL SLOPES -> 2
```

Figure 19. Default topography mix for the 5 major land use options - dragline mine run.

a) cropland
b) high human use
c) water recreation
d) native vegetation
e) wildlife management

These averages vary slightly because the lowest slope value is set when the user inputs the general slope of the surrounding land--for all 5 land use options. If the surrounding lands are greater than 5.7 degrees in average slope, the cropland and high use options are not feasible - and a message to this effect will be delivered.

2) These mixtures meet legal constraints. In the case of cropland, slopes cannot exceed 5.7 degrees (8 percent) slopes.

3) The slope mixtures help prevent wasting money. If an inexperienced user grades all of his spoils to level or 5.7 degree topography, then calls the area a wildlife management area, he has wasted money by grading the area too flat for his intended purpose.

The user has the option of using these grading values, or he can modify some or all of them, within limits (Table 1). Figure 20 shows an example of how the slopes for a certain land use may be modified within legal or practical limits. If the user exceeds these limits, an error or other message will appear.

Table 1. Summary of mandatory and recommended slope grading limits for 5 main land uses.

Cropland	100% $\leq$ 5.7°	Must Do
High use	75% $\leq$ 5.7 25% > 5.7 $\leq$ 11.5	Recommended
Water rec.	50% $\leq$ 5.7 40% > 5.7 $\leq$ 11.5 10% > 11.5 $\leq$ 19	Recommended
Native veg.	50% $\leq$ 5.7 25% > 5.7 $\leq$ 11.5 25% > 11.5 $\leq$ 19	Recommended
Wildlife	35% $\leq$ 5.7 40% > 5.7 $\leq$ 11.5 25% > 11.5 $\leq$ 19	Recommended

```
   . . .

   READY TO ACCEPT SLOPE/PERCENT PAIRS FOR CROPLAND

 > INPUT SLOPE, THEN A COMMA, FOLLOWED BY THE PERCENT OF THE
   AREA YOU WANT COVERED BY THAT SLOPE.

 > 10 SLOPE / PERCENT PAIRS ARE ALLOWED.


   RESTRICTIONS :

 > FINAL SLOPE MUST NOT EXCEED 5.70 DEGREES
 > FINAL SLOPE MUST BE AT LEAST  1.00 DEGREES
 > TOTAL PERCENTAGE MUST EQUAL 100

   CURRENT PERCENTAGE DEFINED IS :    .00 %
   INPUT SLOPE, PERCENT -> 4,50

   CURRENT PERCENTAGE DEFINED IS : 50.00 %
   INPUT SLOPE, PERCENT -> 5.7,50

   DO YOU HAVE ANOTHER MODIFICATION ?
    (YES OR NO) -> NO

   WOULD YOU LIKE TO VIEW THE TABLE AGAIN ?
    (YES OR NO) -> YES

   WOULD YOU LIKE THE TABLE DISPLAYED ON
THE TERMINAL, OR THE LINE PRINTER ?  (TT OR LP)->TT
```

Figure 20. Modifying of default slope values within legal limits.

After the user has entered his acceptable final slope values, the computer will use them for all volume and cost computations in TECON (see this section later for methods). At this point, the user may also look at what his grading volumes and costs will be for each specific land use option (Figs. 21, 22). These costs will be summarized later in the TECON analysis. A reminder that grading slope values have been entered for all computations is presented next, and during later routines (Fig. 23).

b. Dragline type mine - opening cut

The data entries for the dragline opening cut spoil bank are slightly different (Fig. 24), which reflects the shape of this large, single spoil pile perched above the initial highwall. Graphical and tabular cost summaries are provided for the user as in the mine run example above (Figs. 25, 26). However, it should be noted that the lower left hand graph for the opening cut spoils (Fig. 25) depicts final slope versus final graded spoils width, not cost per acre. This is because the final acreage varies with how flat the spoils are graded. In fact, if the spoils are graded flat enough, the acreage begins to increase faster than the cost, and the cost per acre would start to fall.

Because of the size of the spoil pile, it would be very expensive to grade it down to the general slope of the surrounding land, or even to 5.7 degrees--the maximum allowed for crops. (In fact, it is theoretically impossible to grade it to 0 degrees.) Consequently, those land use options that require more than 50 percent of the area to be less than or equal to 5.7 degrees (cropland and high use) are deemed not to be practical land use options for the opening cut spoils. For the other 3 land use options, the default grading topography is altered so as to not include slopes less than 11.5 degrees or 20 percent (Fig. 27). If the user inputs the original spoil slopes at less than 11.5 degrees, no grading will be done, with no costs passed to TECON, so TECON could not calculate a reclamation cost.

As with the mine run spoils, these default grading parameters may be modified (Fig. 28) but within certain limits (Fig. 29). Once the final topography has been set, these values are used for all future cost calculations.

c. Dragline type mine - final cut

The final box cut at a dragline type mine involves grading down both the final highwall and the final spoil bank peak. Therefore, the data entry requirements are slightly different (Fig. 30). The graphics and tabular aids for cost relationships are the same as for the mine run example described previously.

```
SELECT THE SUMMARY TABLE YOU WISH TO VIEW
0->NONE
1->CROPLAND
2->NATIVE VEGETATION
3->WILDLIFE
4->WATER RECREATION
5->HIGH USE
NOTE: OPTIONS 1 AND 5 NOT AVAILABLE FOR THE
      OPENING AND FINAL CUT OPTIONS

ENTER YOUR SELECTION HERE -> 1
DISPLAY ON TT OR LP ? -> TT
```

Figure 21. Option allowing review of grading volumes and costs for each land use option.

MINE RUN OPTION - CROPLAND

FINAL SLOPE (DEGREES)	PERCENT OF TOTAL AREA	VOLUME MOVED (CU-YDS)	GRADING COST	AVERAGE COST PER ACRE
1.0	50.0	1190367.5	$ 297591.87	$ 1983.95
5.7	50.0	1041128.1	$ 260282.03	$ 1735.21
TOTALS:	100.0	2231495.5	$ 557873.87	$ 1859.58

HIT THE RETURN KEY TO CONTINUE....

Figure 22. Grading volumes and costs for dragline mine run spoils - cropland land use slopes.

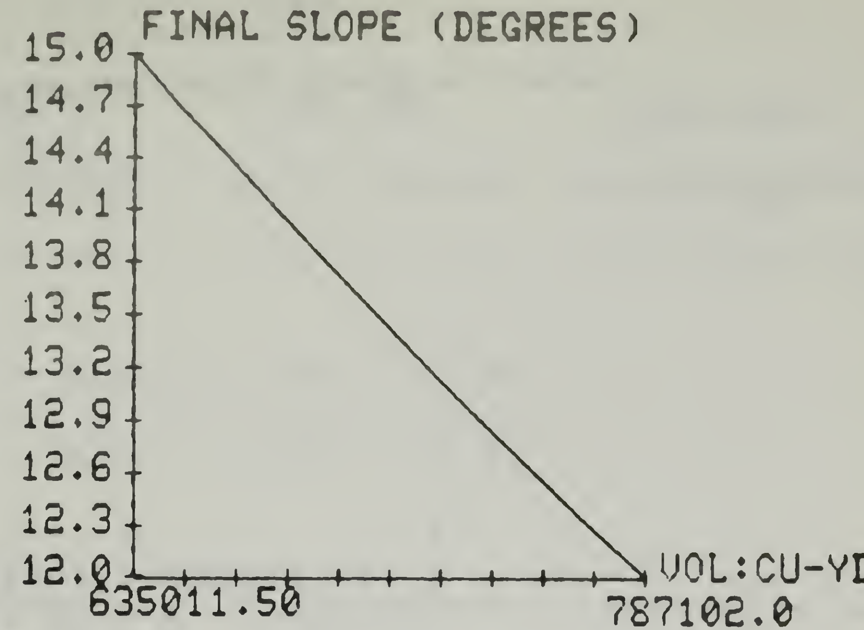
```
GENERAL DESCRIPTION STATUS :

GRADING PARAMETERS HAVE BEEN ENTERED FOR :

* CROPLAND ALTERNATIVE

* NAT.VEG. ALTERNATIVE

* WILDLIFE ALTERNATIVE

* WAT.REC. ALTERNATIVE

* HIGH USE ALTERNATIVE

HIT THE RETURN KEY TO CONTINUE....
```

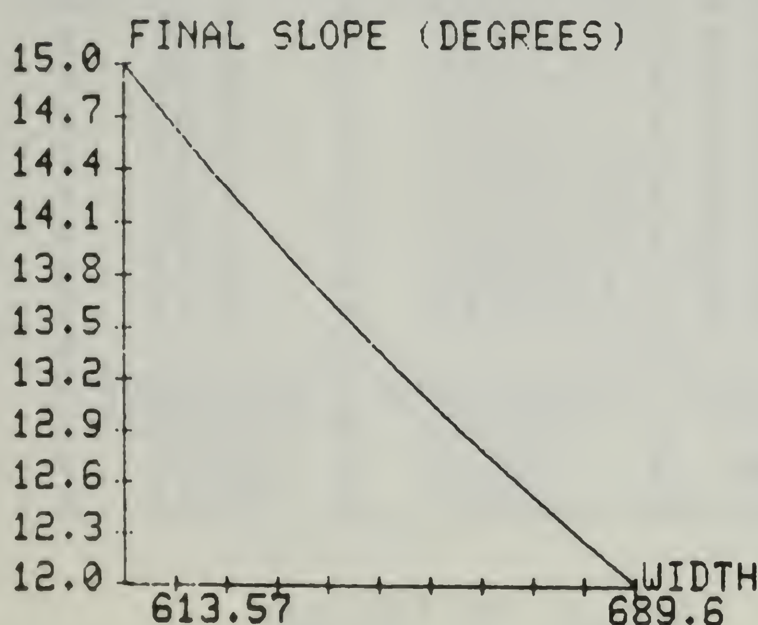
Figure 23. Reminder message that grading data have been entered for all further calculations.

```
--- DRAGLINE/OPENING CUT ---

HEIGHT OF THE SPOIL BANK (FEET) -> 130

INITIAL AVERAGE SLOPE OF THE SPOIL (DEGREES) -> 34

LENGTH OF THE SPOIL BANK (YARDS) -> 1000

AVERAGE SLOPE OF THE AREA PERPENDICULAR TO
THE SPOIL BANK AXIS -> 1

COST OF GRADING SPOILS (CENTS/CU.YD) -> 25
```

Figure 24. Data entries for dragline opening cut spoils.

```
DRAGLINE - OPENING CUT

CURRENT INPUT DATA:

SPOIL BANK HEIGHT   : 130.00 FT.
INITIAL SPOIL SLOPE:  34.00 DEG
SPOIL BANK LENGTH  :1000.00 FT.
SLOPE OF THE AREA  :    1.00 DEG
COST OF GRADING     :25.00 C/C-Y
 HIT RETURN TO CONTINUE..
```





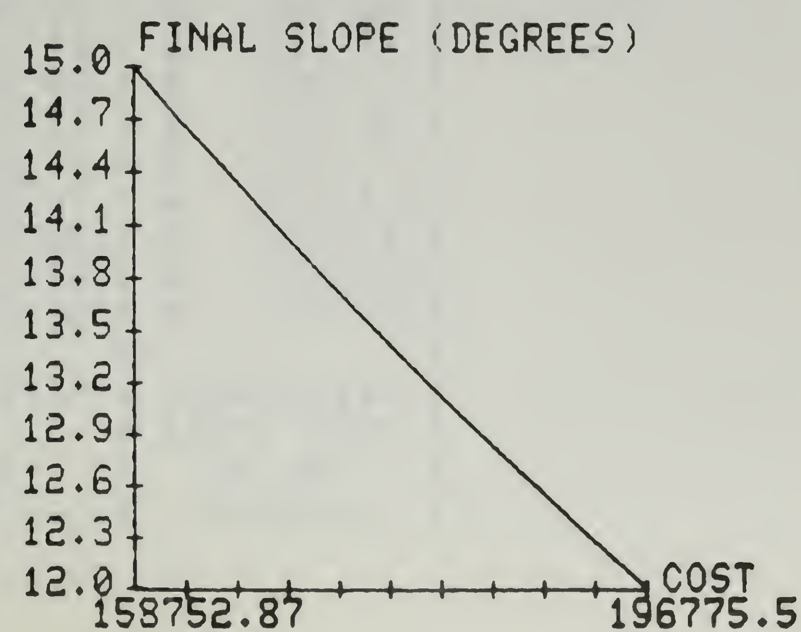


Figure 25. Cost relationships for slope versus volume, total cost, and final bank width

OPENING CUT OPTION

FINAL SLOPE (DEGREES)	VOLUME MOVED (CU-YDS)	TOTAL GRADING COST	WIDTH OF THE FINAL BANK
11.0	844973.0	$ 211243.25	$ 721.58
11.8	798349.1	$ 199587.28	$ 695.64
12.6	754273.0	$ 188568.25	$ 672.20
13.4	712437.2	$ 178109.31	$ 650.87
14.2	672599.5	$ 168149.87	$ 631.34
15.0	634544.7	$ 158636.19	$ 613.35
15.8	598100.1	$ 149525.03	$ 596.71
16.6	563104.7	$ 140776.19	$ 581.24
17.4	529421.5	$ 132355.37	$ 566.80
18.2	496939.7	$ 124234.92	$ 553.28
19.0	465937.1	$ 116484.27	$ 540.73

HIT RETURN TO CONTINUE.....

Figure 26. Tabular summary of volume-cost relations for grading opening cut spoils--dragline mine.

```
                        CURRENT SLOPE-PERCENT PAIRS
                        ===========================

   CROPLAND       NAT.VEG.       WILDLIFE       WAT.REC.       HIGH USE
SLOPE-PERCENT  SLOPE-PERCENT  SLOPE-PERCENT  SLOPE-PERCENT  SLOPE-PERCENT
-------------  -------------  -------------  -------------  -------------

      -        11.50 - 50.00  11.50 - 50.00  11.50 - 75.00        -
      -        15.00 - 25.00  19.00 - 50.00  19.00 - 25.00        -
      -        19.00 - 25.00        -              -              -
=========================================================================
SELECT: 1=>PROCEED,2=>MODIFY SOME SLOPES,3=>RE-DEFINE ALL SLOPES -> 2
```

Figure 27. Default slope values for grading of the opening cut spoil bank, dragline mine.

```
    WHICH ALTERNATIVE DO YOU WANT TO MODIFY ?

      0) NONE
      1) NATIVE VEGETATION
      2) WILDLIFE
      3) WATER RECREATION
ENTER THE APPROPRIATE NUMBER HERE -> 1
```

Figure 28. Modifications available for dragline opening cut default grading values.

```
READY TO ACCEPT SLOPE/PERCENT PAIRS FOR NAT.VEG.

> INPUT SLOPE, THEN A COMMA, FOLLOWED BY THE PERCENT OF THE
  AREA YOU WANT COVERED BY THAT SLOPE.

> 10 SLOPE / PERCENT PAIRS ARE ALLOWED.


  RESTRICTIONS :

> FINAL SLOPE MUST NOT EXCEED 19.0 DEGREES
> FINAL SLOPE MUST BE AT LEAST 11.00 DEGREES
> TOTAL PERCENTAGE MUST EQUAL 100


  WE RECOMMEND THE FOLLOWING RANGE OF SLOPES:
  50% GREATER THAN OR EQUAL TO 11.5, AND LESS
  THAN 14 DEGREES
  25% GREATER THAN OR EQUAL TO 14, AND LESS
  THAN 17 DEGREES
  25% GREATER THAN OR EQUAL TO  17, AND LESS
  THAN 19 DEGREES


  CURRENT PERCENTAGE DEFINED IS :   .00 %
  INPUT SLOPE, PERCENT -> 12,50

  CURRENT PERCENTAGE DEFINED IS : 50.00 %
  INPUT SLOPE, PERCENT -> 15,50

  DO YOU HAVE ANOTHER MODIFICATION ?
   (YES OR NO) -> NO
```

Figure 29. Limitation example for modifying opening cut spoils default grading values - native vegetation

```
--- DRAGLINE/FINAL CUT ---

WIDTH OF BOTTOM OF THE PIT (FEET)->120
TOTAL LENGTH OF THE PIT (YARDS) -> 1000
VERTICAL HEIGHT OF THE HIGHWALL (FEET) -> 110
VERTICAL HEIGHT OF THE SPOIL BANK (FEET) -> 130
AVERAGE INITIAL SLOPE OF THE HIGHWALL (DEG) -> 72
AVERAGE INITIAL SLOPE OF THE SPOIL BANK (DEG) -> 34
COST OF GRADING SPOILS (CENTS/CU.YD) -> 20
```

Figure 30. Data requirements for grading down spoils of final box cut--dragline type mine.

The final cut grading, like the opening box cut spoils, requires the moving of very large amounts of material. Consequently, the final land use options, and their default final graded topographies, are the same as for the opening cut example (Fig. 31). These default slopes may be modified within the same limits described for opening cut spoils. Once this is done, the values are used, where necessary, for all further cost calculations. In spite of these practical grading limitations for opening cut and final cut spoils, it may be necessary to reclaim to level topography, where prime agricultural land is present. In these cases, a haulback of opening cut spoil to the final cut pit is the most commonly required technique, rather than massive grading.

d. Truck and shovel type mine - opening cut

When the user indicates he is dealing with a truck and shovel mine (see Fig. 32), an entirely different set of input data is required to determine grading volumes and costs. If the user, at this point, does not want to complete the extensive data requirements for the truck and shovel mine, he may hit "-1" as the cost of grading spoils, and CLAIM will exit from this routine.

For the opening cut spoils, the material is removed from the pit, and stacked on a nearby land surface in a series of "stairsteps" that ultimately form a pyramid or cone-shaped mound, which then must be graded down to some final desired topography. The basic data entered into the CLAIM system are the descriptions of the highwall-bench pairs that make up these stairsteps, as described in the following paragraphs.

Four items must be entered for each highwall/bench pair (see Figs. 33-35 for data input for 3 h/b pairs):

1) The vertical height of the highwall, in feet

2) The initial width of the bench, in feet

3) The initial average slope of the highwall, in degrees

4) The length of the bench along the outside edge, in feet.

Ten highwalls and benches may be described. H/B pairs are entered starting with the bottom highwall, referred to as highwall #1 (Fig. 33), and proceeding upward until done. The width of the top bench must be no greater than one-half the top of the hill. It is the user's responsibility to ensure this restriction. The method of input is as follows (capital letters denote screen display):

CURRENT SLOPE-PERCENT PAIRS

CROPLAND SLOPE-PERCENT	NAT.VEG. SLOPE-PERCENT	WILDLIFE SLOPE-PERCENT	WAT.REC. SLOPE-PERCENT	HIGH USE SLOPE-PERCENT
-	11.50 - 50.00	11.50 - 50.00	11.50 - 75.00	-
-	15.00 - 25.00	19.00 - 50.00	19.00 - 25.00	-
-	19.00 - 25.00	-	-	-

SELECT: 1=>PROCEED,2=>MODIFY SOME SLOPES,3=>RE-DEFINE ALL SLOPES -> 1

Figure 31. Default slope values for three major land uses feasible for final box cut - dragline mine.

```
I.) GENERAL DESCRIPTION:  ***************************************************
                          *              STANDARD EXPECTATIONS              *
                          ***************************************************
                          *CROP*  NATIVE   *WILD*  WATER    *HIGH*OTHER*
                          *LAND*VEGETATION*LIFE*RECREATION*USE *     *
*****************************************************************************
                          *    *          *    *          *    *     *
 B.) STAGE IN MINING      *    *          *    *          *    *     *
     SEQUENCE :           *    *          *    *          *    *     *
  1.) OPENING BOX CUT     *  1 *     1    *  2 *     1    *  1 *   0 *
  2.) MINE RUN            *  2 *     2    *  2 *     2    *  2 *   0 *
  3.) FINAL BOX CUT       *  1 *     1    *  3 *     3    *  1 *   0 *
ENTER THE APPROPRIATE     ***************************************************
NUMBER, OR ZERO TO QUIT -> 1
*****************************************************************************
                          *    *          *    *          *    *     *
 C.) AVERAGE SLOPE OF     *    *          *    *          *    *     *
     10 RANDOM POINTS     *    *          *    *          *    *     *
     IN THE AREA :        *    *          *    *          *    *     *
  1.)  0.00 - 3.00        *  3 *     2    *  2 *     2    *  3 *   0 *
  2.)  3.01 - 5.70        *  2 *     3    *  2 *     3    *  2 *   0 *
  3.)  5.71 - 11.50       *  0 *     2    *  3 *     2    *  1 *   0 *
ENTER THE APPROPRIATE     ***************************************************
NUMBER, OR ZERO TO QUIT -> 1

     *** TRUCK AND SHOVEL MINE ***

     ENTER COST OF GRADING SPOILS(CENTS/CU.YD) -> 25
```

Figure 3[illegible]. Start of truck and shovel data entry.

```
** TRUCK AND SHOVEL SEGMENT - CROPLAND ALTERNATIVE **

INPUT WALL/BENCH INFORMATION :

> BEGIN WITH BOTTOM HIGHWALL AND BENCH
  PROCEEDING UPWARD UNTIL DONE

> WHEN DONE, ENTER ZERO FOR THE HEIGHT
  OF WHAT WOULD HAVE BEEN THE NEXT HIGHWALL

> 10 HIGHWALL//BENCH PAIRS ARE ALLOWED

> WIDTH OF TOP BENCH CAN BE NO GREATER
  THAN ONE HALF THE WIDTH OF THE HILL TOP


NOW DESCRIBING HIGHWALL/BENCH  PAIR # 1

VERTICAL HEIGHT OF HIGHWALL (FEET) ->  35
WIDTH OF THE BENCH (FEET) -> 200
INITIAL SLOPE OF THE HIGHWALL (DEGREES) -> 34
LENGTH OF BENCH ALONG OUTSIDE EDGE (FEET) -> 1000
```

Figure 33. Data input restrictions for truck and shovel opening cut spoils.

```
NOW DESCRIBING HIGHWALL/BENCH  PAIR # 2

VERTICAL HEIGHT OF HIGHWALL (FEET) ->  35
WIDTH OF THE BENCH (FEET) -> 200
INITIAL SLOPE OF THE HIGHWALL (DEGREES) -> 34
LENGTH OF BENCH ALONG OUTSIDE EDGE (FEET) -> 100
```

Figure 34. Typical input data for second highwall/bench pair - truck and shovel opening cut spoils.

```
NOW DESCRIBING HIGHWALL/BENCH  PAIR # 3

VERTICAL HEIGHT OF HIGHWALL (FEET) ->  35
WIDTH OF THE BENCH (FEET) -> 200
INITIAL SLOPE OF THE HIGHWALL (DEGREES) -> 34
LENGTH OF BENCH ALONG OUTSIDE EDGE (FEET) -> 1000
```

Figure 35. Typical input data for third highwall/bench pair - truck and shovel opening cut spoils.

(i) VERTICAL HEIGHT OF THE HIGHWALL (FEET) →

Valid input is a number greater than or equal to zero. If zero is entered, CLAIM assumes that the user has completed his H/B description, and CLAIM branches to item (vi) below. Should the user mistakenly input a zero, or a character that CLAIM interprets as a zero (say, the letter N); the user may correct the situation as described in item (vi) below. If a value less than zero is entered, the message:

ERROR → VALUE MUST BE GREATER THAN ZERO

is presented, and CLAIM re-displays item (i). Any positive number (within the limits of computer capability) is accepted as valid data, and CLAIM continues to item (ii).

(ii) WIDTH OF THE BENCH (FEET) →

Valid input is a number greater than zero. If a number less than or equal to zero is entered, the message:

ERROR → VALUE MUST BE GREATER THAN ZERO

is presented, and CLAIM re-displays item (ii). A valid entry causes CLAIM to continue onto item (iii).

(iii) INITIAL SLOPE OF THE HIGHWALL (DEGREES) →

Valid input is a number greater than zero and less than 90. If a valid entry is read, then CLAIM proceeds to item (iv); otherwise the message:

ERROR → SLOPE MUST BE BETWEEN 0 AND 90 DEG.

is shown and item (iii) is re-displayed. Only one average slope per highwall is allowed.

(iv) LENGTH OF BENCH ALONG OUTSIDE EDGE (FEET) →

Valid input for bench one, the lowest bench, is a number greater than zero. If a number less than or equal to zero is read, the message:

ERROR → VALUE MUST BE GREATER THAN ZERO

is presented, and item (iv) re-displayed. A valid entry causes CLAIM to branch to item (i) to receive the next H/B pair.

Valid input for benches greater than 1 is a number greater than zero and less than or equal to the bench length of the bench immediately below it. It is necessary that this condition be met because this bench will be graded onto the lower bench. An invalid entry causes the message:

ERROR → LENGTH MUST NOT EXCEED XXXXX.XX FEET

to be displayed. (Note → "XXXXX.XX" is the length of the lower bench.) Item (iv) is then represented. Should a valid entry be read, CLAIM branches to item (i) for the next H/B pair, unless 10 H/B pairs have already been entered, in which case CLAIM continues on to item (v) (Fig. 36).

(v) INPUT SPOIL PILE CONFIGURATION CODE:

1 → SEMI-CIRCULAR SPOILS

2 → RECTANGULAR SPOILS

ENTER CONFIGURATION BEST DESCRIBING SPOILS →

Note:

Here, the user is asked to describe the geometric shape of the "top view" of the spoils. By "semi-circular" we mean that the topographical contours approximate areas of circles <u>symmetric about a common origin</u>. "Rectangular" spoils, as the name implies, means that the topographical contours approximate rectangles.

Valid inputs are the numbers 1 or 2. Any other entry causes item (v) to be redisplayed. A valid entry causes CLAIM to continue onto item (vi).

(vi) HIGHWALL/BENCH PAIR NUMBER OF EDIT (Ø TO QUIT) →

Note:

Prior to display of item (vi), CLAIM displays the current data (Fig. 37).

Valid input is a number greater than or equal to zero, and less than or equal to the number of H/B pairs currently defined <u>plus one</u> (unless 10 pairs have been entered). If the entry is zero, CLAIM assumes that the user is satisfied with the data entered and CLAIM branches to item (viii). If the entry is <u>one greater</u> than the number of H/B pairs currently defined, CLAIM branches back to item (i) and allows more H/B pairs to be described, provided that the maximum of ten pairs will not be exceeded. If the entry corresponds to one of the H/B pairs currently defined, CLAIM branches to item (vii) below. If the user enters an invalid response, CLAIM redisplays the summary table and branches to (vi) again.

```
NOW DESCRIBING HIGHWALL/BENCH  PAIR # 4

VERTICAL HEIGHT OF HIGHWALL (FEET) ->  0

INPUT SPOIL PILE CONFIGURATION CODE :
1-> SEMI-CIRCULAR SPOILS
2-> RECTANGULAR SPOILS
ENTER CONFIGURATION BEST DESCRIBING SPOILS -> 1
```

Figure 36. Selection of general spoil pile shape.

```
*** CURRENT HIGHWALL/BENCH DATA ***

PAIR #   HW HEIGHT   HW SLOPE   BENCH WIDTH   BENCH LENGTH
------   ---------   --------   -----------   ------------

 1         35.00      34.00       200.00        1000.00
 2         35.00      34.00       200.00         100.00
 3         35.00      34.00       200.00        1000.00

HIGHWALL/BENCH PAIR NUMBER OF EDIT (0 TO QUIT)->2

ITEM TO BE EDITED ?
0 -> DONE
1 -> HIGHWALL HEIGHT
2 -> BENCH WIDTH
3 -> HIGHWALL SLOPE
4 -> BENCH LENGTH
ENTEP YOUR SELECTION -> 4
   LENGTH OF BENCH ALONG OUTSIDE EDGE (FEET) -> 1000
```

Figure 37. Review of data and example of editing the bench length of highwall/bench #2.

(vii) ITEM TO BE EDITED?

0 → DONE

1 → HIGHWALL HEIGHT

2 → BENCH WIDTH

3 → HIGHWALL SLOPE

4 → BENCH LENGTH

ENTER YOUR SELECTION →

Valid entries are the numbers 0, 1, 2, 3, or 4. Any other entry causes item (vii) to be redisplayed. Depending on the user's entry, the following occurs:

0 : the program redisplays the table, and branches to (vi).

1 : CLAIM displays item (i). Valid data are numbers greater than zero. Invalid data cause item (i) to be redisplayed.

2 : CLAIM displays item (ii). Valid datum is a number greater than zero. Invalid data cause item (ii) to be redisplayed.

3 : CLAIM displays item (iii). Valid datum is a number between 0 and 90. Invalid data redisplay item (iii).

4 : CLAIM displays item (iv) (see Fig. 37 for an example). Valid data for bench #1, the lowest bench, are numbers greater than or equal to the length of the bench immediately above if more than one bench has been entered, or greater than zero if only one H/B pair has been entered. Valid data for all other benches are numbers greater than or equal to the length of the bench immediately above, and less than or equal to the length of the bench below. Invalid data cause item (iv) to be redisplayed.

Note:

Valid responses to 1-4 above cause item (vii) to be redisplayed.

(viii) At this point, CLAIM assumes that all H/B data have been successfully described. The conditions for bench length inputs described above are satisfactory for rectangular spoils, however, semi-circular spoils must be checked further, to ensure that no illogical data have been entered (Fig. 38). Obviously, there is no limit on the length of

```
*** CURRENT HIGHWALL/BENCH DATA ***

PAIR #   HW HEIGHT   HW SLOPE   BENCH WIDTH   BENCH LENGTH
------   ---------   --------   -----------   ------------

  1        35.00       34.00       200.00        1000.00
  2        35.00       34.00       200.00        1000.00
  3        35.00       34.00       200.00        1000.00

HIGHWALL/BENCH PAIR NUMBER OF EDIT (0 TO QUIT)->0

   BENCH LENGTH  2 'S VALUE OF      1000.000 FEET
   HAS BEEN ADJUSTED TO      2259.511 FEET

   BENCH LENGTH  1 'S VALUE OF      1000.000 FEET
   HAS BEEN ADJUSTED TO      3519.021 FEET

   HIT THE RETURN KEY TO CONTINUE ....
```

Figure 38. Computer adjustment of circular bench lengths input by user so that they will actually fit on the hill described by the highwall angles and slopes, and bench widths.

a rectangular bench, however, a "semi-circular" bench cannot exceed the circumference of a full circle. (Recall that by "semi-circular", we are referring to arcs of circles - the "arc" may describe a full circle.) The term "semi-circular" was selected to describe this situation since it is the most common configuration assumed by truck and shovel spoils when they are piled against a hill.

When the user inputs a series of highwall heights and angles, along with bench widths between these highwalls, he describes a hill with a general overall angle of repose. The computer then checks the width and length of the uppermost bench, and then calculates the arc (up to a full circle) this describes. If it is greater than a full circle, the arc length will be shortened as needed. Once this is done, the computer records the angle at which the two sides of the semi-circular spoils meet the hill (360 degrees or less). Once the computer has this value, it cycles down to the next bench and, from its slope, width, and length, calculates what angle its sides would meet the hill. Again, if it is more than 360 degrees, the bench length will be shortened to a full circle maximum. If the lower bench length makes an arc of less than 360 degrees, the computer checks to see if the angle at which it meets the hill is less than or equal to the angle of the uppermost bench. If this is true, the bench length is long enough to accept the graded spoils from the bench immediately above, and it is left as is. If the angle is greater than the uppermost angle, then that highwall's bench length is increased so it will meet the hill at the same angle as the uppermost bench, and therefore will be long enough to accept spoils graded from the bench above.

Because of the way the computer adjusts the highwall bench lengths, the following rules should be remembered when a user makes changes to these input data:

1) When any bench width is changed, this moves all lower benches in or out from the hill a corresponding amount. If they are moved, their arc lengths must become longer, or shorter, so that they meet the hill at the same angle they did before the width change was made.

2) If any bench's length is shortened by the user, this will not cause a shortening of lower benches, since they will be more than long enough to accept the spoils from the newly shortened bench.

3) If any but the top bench is shortened too much, however, so that it is not long enough to accept spoils from above, it will be lengthened by the computer so that it will meet the hill at the same angle as the bench above it.

4) If any bench is lengthened by the user, all benches below it will be lengthened (if necessary) so that they meet the hill at the same, new, angle as the recently lengthened bench.

5) Any change in a highwall height, or its angle of repose, has a net effect of increasing or decreasing the width of the bench above it. This, in turn, will result in the relationships described in items 1-4 above.

For a complete mathematical description of the methodology used in determining the maximum bench length, see the program documentation--(Subroutine TSBLA). In addition to testing for maximum bench lengths, minor adjustment to the current bench lengths may be required to ensure that the lower benches are long enough to accomodate grading of the upper benches. Should any adjustments be required, the adjustments are listed, and CLAIM branches to item (vi) again (Fig. 39). Otherwise the program proceeds to final slope description. If other edits to the input data are needed, this is also allowed (Fig. 40).

Once logical input data for the highwall/bench pairs have been entered by the user and the computer, CLAIM offers the user the option of inputting final grading topography in either a graphic or nongraphic mode (Fig. 41). When the user selects the nongraphic mode, he is given a set of default grading values, as in the previously described dragline mining example, and for the same reasons. For truck and shovel spoils, during all mining stages (opening cut, mine run, and final cut), all 5 land use options are economically feasible, in terms of grading geometry. Consequently, the first set of default grading values are for cropland (Fig. 42). The following (Table 2) summarizes all of the truck and shovel default grading slopes.

Table 2. Default truck and shovel grading slopes for all 5 land use options (degrees).

Bench #	Cropland	Native Veget.	Wildlife	Water Rec.	High Use
1	5.7	8	11.5	8	5.7
2	5.7	11.5	19	11.5	8
3	5.7	19	5.7	5.7	11.5

```
*** CURRENT HIGHWALL/BENCH DATA ***

PAIR #  HW HEIGHT  HW SLOPE  BENCH WIDTH  BENCH LENGTH
------  ---------  --------  -----------  ------------

 1        35.00     34.00       200.00        3519.02
 2        35.00     34.00       200.00        2259.51
 3        35.00     34.00       200.00        1000.00

HIGHWALL/BENCH PAIR NUMBER OF EDIT (0 TO QUIT)->0

   HIT THE RETURN KEY TO CONTINUE ....
```

Figure 39. Input of new values for bench lengths for semi-circular spoils, by the computer.

```
                 *** CURRENT HIGHWALL/BENCH DATA ***

PAIR #  HW HEIGHT  HW SLOPE  BENCH WIDTH  BENCH LENGTH
------  ---------  --------  -----------  ------------

 1        35.00     34.00       200.00        1000.00
 2        35.00     34.00       200.00        1000.00
 3        35.00     34.00       200.00        1000.00
 4        35.00     34.00       200.00        1000.00
 5        35.00     23.00       200.00         900.00

HIGHWALL/BENCH PAIR NUMBER OF EDIT(0 TO QUIT) ->4

ITEM TO BE EDITED ?
0 -> DONE
1 -> HIGHWALL HEIGHT
2 -> BENCH WIDTH
3 -> HIGHWALL SLOPE
4 -> BENCH LENGTH
ENTER YOUR SELECTION -> 4
   LENGTH OF BENCH ALONG OUTSIDE EDGE(FEET) -> 1200

   ERROR. BENCH LENGTH MUST BE GREATER THAN OR
   EQUAL TO    900.00 FEET, AND LESS THAN OR EQUAL
   TO   1000.00 FEET. TRY AGAIN.
   LENGTH OF BENCH ALONG OUTSIDE EDGE(FEET) -> 950
```

Figure 40. Editing of a bench length (rectangular spoils configuration).

```
READY TO INPUT FINAL SLOPES.
 1 -> GRAPHIC MODE
 2 -> NON - GRAPHIC MODE
ENTER YOUR SELECTION -> 2
```

Figure 41. User option of graphic or nongraphic final slope input.

```
*** INPUT FINAL SLOPES ***

 * CROPLAND ALTERNATIVE  *

DEFAULT SLOPES :
HIGHWALL/BENCH PAIR   DEFAULT SLOPE VALUE
-------------------   -------------------

         1                    5.70
         2                    5.70
         3                    5.70

SELECT ONE OF THE FOLLOWING :
1) USE THE DEFAULT VALUES
2) I'LL USE MY OWN VALUES
ENTER 1 OR 2 -> 2

THE MINIMUM REQUESTABLE SLOPE FOR HIGHWALL # 1
IS  4.43 DEGREES. THIS SLOPE WILL REDUCE THE WIDTH OF
BENCH #  1 TO ABOUT ZERO.

INPUT THE FINAL SLOPE FOR HIGHWALL #  1 -> 5.7

THE MINIMUM REQUESTABLE SLOPE FOR HIGHWALL # 2
IS 12.88 DEGREES. THIS SLOPE WILL REDUCE THE WIDTH OF
BENCH #  1 TO ABOUT ZERO.

INPUT THE FINAL SLOPE FOR HIGHWALL #  2 -> 5.7

ERROR -> THE CURRENT MINIMUM SLOPE REQUEST FOR
HIGHWALL  2 IS 12.88 DEGREES. YOU CAN :
1) RE-ENTER YOUR VALUE
```

```
    2) START OVER
    3) OBTAIN A SUGGESSTION THAT WIL
L LET YOU USE THIS SLOPE
    4) EXIT FROM THIS ROUTINE
    ENTER YOUR CHOICE HERE -> 3
```

Figure 42. Default cropland grading values, and minimum slopes possible, for benches as they were input.

The default slope values are set for a "typical" 3-bench mine. If more benches are present, the system cycles back through the same 3 values over and over. Only one slope angle is allowed per bench and, since the bench lengths get much shorter as the operation proceeds up the hill, the bottom 2 benches will generally supply the major part of the final graded topography. Emphasizing these 2 benches, the land uses are arranged in the same order as they were for the previous dragline example--in terms of flattest to hilliest topography. The order is: cropland; high use; water recreation; native vegetation; and wildlife management.

After obtaining the default values, the user may use these, or modify them within recommended limits (Fig. 42). Figures 42-51 show the interactive sequence which occurs if the user elects to use his own values, while Fig. 52 shows that the computer does this automatically if the user elects to use all the default values.

If the user inputs his own values (Fig. 42), the computer first calculates the minimum slope the first highwall can be graded down to, <u>without having unnecessary regrading of spoils</u> (which would theoretically allow the bench to be graded almost flat at an infinite distance). If the user inputs a slope greater than this minimum, the computer accepts the value, and proceeds to the next slope (Fig. 42). If a user inputs a fairly flat final slope for his first highwall, the next highwall cannot be graded very flat, because bench #1 has been mostly graded away to meet the needs of highwall #1. If the user is still required to grade the second highwall nearly flat because of some constraint (such as the 5.7 degree legal limit for cropland, Fig. 42), he can still input that value. The computer calculates that this does not fit, and announces an "error" (Fig. 42), but does offer the user the options of using a different value (if possible) or it will calculate a new lower bench width that will provide enough room both for grading down the first and second highwall (Fig. 43).

Once the width of this first bench has been widened, this also has an effect on its length, given that we started with semi-circular spoils. The increased bench width increases the arc length of the outside edge of the bench (centered around the same hill as originally described), so the computer calculates this new bench length to fit the same hill (Fig. 44). Once this is done, the computer cycles to the next higher bench (Fig. 45). If the user tries to exceed the maximum allowable value for cropland (Fig. 45), a warning is issued, and he is asked to put in a value less than or equal to the maximum (Fig. 46). If this final slope will not fit, the computer again calculates the bench width necessary to accommodate the graded spoils (Fig. 47). This width change then requires a length change in <u>both</u> benches 1 and 2 (Fig. 48).

```
SUGGESTION :

IF YOU INCREASE BENCH  1 FROM  200.00 FEET , TO
 298.32 FEET, THE FINAL SLOPE VALUE OF  5.70 DEGREES
WILL WORK.

YOU CAN :
1) IMPLEMENT THE ABOVE SUGGESTION
2) USE YOUR OWN BENCH ADJUSTMENTS
3) INPUT A DIFFERENT SLOPE VALUE
4) RE-INPUT ALL FINAL SLOPES FOR THIS ALTERNATIVE
5) EXIT FROM THIS OPTION
ENTER YOUR CHOICE HERE -> 1
```

Figure 43. Computer-suggested bench increase to allow grading highwalls 1 and 2 to 5.7 degrees.

```
BENCH LENGTH  1 'S VALUE OF      3519.021 FEET
HAS BEEN ADJUSTED TO      4013.118 FEET

HIT THE RETURN KEY TO CONTINUE ....
```

Figure 44. Computer adjustment of the arc length of bench #1 in response to the widening of the bench (semi-circular spoils only).

```
THE MINIMUM REQUESTABLE SLOPE FOR HIGHWALL # 3
IS 12.88 DEGREES. THIS SLOPE WILL REDUCE THE WIDTH OF
BENCH #  2 TO ABOUT ZERO.

INPUT THE FINAL SLOPE FOR HIGHWALL #  3 -> 9

ERROR -> SLOPE REQUESTED FOR HIGHWALL  3 TOO LARGE
YOU MAY :
1) RE-ENTER THE SLOPE VALUE
2) START OVER
3) EXIT FROM THIS ROUTINE
ENTER YOUR CHOICE HERE -> 1
```

Figure 45. Error message delivered when user exceeds maximum slope allowed for cropland.

```
THE MINIMUM REQUESTABLE SLOPE FOR HIGHWALL # 3
IS 12.88 DEGREES. THIS SLOPE WILL REDUCE THE WIDTH OF
BENCH #  2 TO ABOUT ZERO.

INPUT THE FINAL SLOPE FOR HIGHWALL #  3 -> 5.7

ERROR -> THE CURRENT MINIMUM SLOPE REQUEST FOR
HIGHWALL  3 IS 12.38 DEGREES. YOU CAN :
1) RE-ENTER YOUR VALUE
2) START OVER
3) OBTAIN A SUGGESSTION THAT WILL LET YOU USE THIS SLOPE
4) EXIT FROM THIS ROUTINE
ENTER YOUR CHOICE HERE -> 3
```

Figure 46. Input of maximum cropland slope for H/B #3.

```
SUGGESTION :
IF YOU INCREASE BENCH  2 FROM  200.00 FEET , TO
 298.82 FEET, THE FINAL SLOPE VALUE OF  5.70 DEGREES
WILL WORK.  YOU MAY :

1) IMPLEMENT THE ABOVE SUGGESTION
2) INCREASE THE BENCH ACCORDING TO YOUR OWN SPECIFICATIONS
3) INPUT A DIFFERENT SLOPE VALUE
4) RE-INPUT ALL FINAL SLOPES FOR THIS ALTERNATIVE
5) EXIT FROM THIS ROUTINE
ENTER YOUR SELECTION HERE -> 1
```

Figure 47. Adjustment of bench #2 width to accommodate grading down of highwall #3.

```
BENCH LENGTH  1 'S VALUE OF     4013.118 FEET
HAS BEEN ADJUSTED TO     4507.214 FEET

BENCH LENGTH  2 'S VALUE OF     2259.511 FEET
HAS BEEN ADJUSTED TO     2753.607 FEET

HIT THE RETURN KEY TO CONTINUE ....
```

Figure 48. Computer adjustment of length of both benches 1 and 2 because of widening of bench #3.

After these data are entered, and the computer has made any necessary bench width and length adjustments, the user is presented with an array of options allowing him to change what has been done, or cycle on through the other 4 land use options (Fig. 49). If the user elects to exit from the current land use option (cropland - Fig. 49), he will be cycled to the next major land use option - native vegetation (Fig. 50). As an aid to the user, he may automatically use the same data that were input in the cropland alternative (data input after they were finally determined by the interactive process) - see Fig. 50. Once these data are entered by the computer, the user again has a choice of inputting final grades in either a graphic or non-graphic mode (Fig. 51). If he chooses the non-graphic mode, the computer presents the native vegetation default slopes (Fig. 52) which may be used or modified. If the user inputs these slopes "as is", they will all easily fit, since the spoils bench widths have already been laid out wide enough to accommodate the relatively flat grading required by the cropland land use. If fact, by using the original cropland h/b data, the user will leave some flat terraces when he grades these same spoils down to the steeper native vegetation slopes. If he wants to eliminate these terraces, the user should answer "no" to the use of cropland input data, and cycle through the same interactive process as described for cropland, above.

By selecting edit option 0, and staying in the truck and shovel routines (Fig. 53), the user proceeds on to the water-based recreation land use option (Fig. 54). In this example, the same data were not used, so the user must reinput the initial highwall/bench data. (The previous wildlife land use input data are not shown, for the sake of brevity). After new data are entered for the benches (same method as described in Figs. 33, 34, 35, 36), a summary table of the new data is presented (Fig. 55). The bench lengths (for semicircular spoils) are adjusted as described previously, and then entered as final input data (Fig. 56).

If desired, the user may opt for the graphic mode (Fig. 57), if he desires to visualize the necessary changes that are being made to the h/b data as he attempts to grade the spoils to a final desired topography. The mathematical process used by the computer to grade spoils in the graphic mode is the same as used in the nongraphic mode. In Fig. 58, the current, input slopes are shown in solid lines, while the calculated minimum slopes are shown with dashed lines. (This general principle is continued throughout the graphic mode - temporary slopes are shown as dashed lines, while finalized slopes are drawn with solid lines.) All drawings are shown near to scale, but because of the limitations to the terminal's screen size, and the possible variation in the number of h/b pairs input by the user, the scale may

```
 *** EDIT  OPTIONS ***

0 -> EXIT FROM THIS LAND USE OPTION

1 -> DISPLAY SUMMARY TABLE OF VOLUME AND COST CALCULATIONS

2 -> EDIT REHANDLE DATA  [ NOT FOR OPENING CUT ]

3 -> EDIT THE SPOIL PILE CONFIGURATION CODE

4 -> SCHEDULE SELECTIVE CHANGES TO INITIAL
     HIGHWALL / BENCH DATA

5 -> SCHEDULE SELECTIVE CHANGES TO FINAL SLOPES

6 -> RE - INPUT ALL INITIAL HIGHWALL / BENCH DATA

7 -> RE - INPUT ALL FINAL SLOPE VALUES

9 -> EDIT THE COST OF GRADING OVERBURDEN
     AND RE-COMPUTE ALL COSTS FOR ALL LAND
     USE OPTIONS CURRENTLY DESCRIBED

   ENTER YOUR SELECTION -> 0
EXIT FROM TRUCK AND SHOVEL ROUTINES ?(YES OR NO) NO
```

Figure 49. Edit options available after data have been entered for the truck and shovel spoils, for the cropland land use.

```
** TRUCK AND SHOVEL SEGMENT - NAT.VEG. ALTERNATIVE **
USE SAME INITIAL DATA AS FOR CROPLAND ? YES
```

Figure 50. Automatic truck and shovel data entry for the second land use option - native vegetation.

```
READY TO INPUT FINAL SLOPES.
 1 -> GRAPHIC MODE
 2 -> NON - GRAPHIC MODE
ENTER YOUR SELECTION -> 2
```

Figure 51. Choice of modes for calculating final grading volumes and costs.

```
*** INPUT FINAL SLOPES ***


 * NAT.VEG. ALTERNATIVE  *

DEFAULT SLOPES :
HIGHWALL/BENCH PAIR   DEFAULT SLOPE VALUE
-------------------    -------------------

         1                      8.00
         2                     11.50
         3                     19.00

SELECT ONE OF THE FOLLOWING :
1) USE THE DEFAULT VALUES
2) I'LL USE MY OWN VALUES
ENTER 1 OR 2 -> 1
```

Figure 52. Use of default topography for grading the native vegetation land use.

```
 *** EDIT  OPTIONS ***

 0 -> EXIT FROM THIS LAND USE OPTION

 1 -> DISPLAY SUMMARY TABLE OF VOLUME AND COST CALCULATIONS

 2 -> EDIT REHANDLE DATA  [ NOT FOR OPENING CUT ]

 3 -> EDIT THE SPOIL PILE CONFIGURATION CODE

 4 -> SCHEDULE SELECTIVE CHANGES TO INITIAL
      HIGHWALL / BENCH DATA

 5 -> SCHEDULE SELECTIVE CHANGES TO FINAL SLOPES

 6 -> RE - INPUT ALL INITIAL HIGHWALL / BENCH DATA

 7 -> RE - INPUT ALL FINAL SLOPE VALUES

 8 -> EDIT THE COST OF GRADING OVERBURDEN
      AND RE-COMPUTE ALL COSTS FOR ALL LAND
      USE OPTIONS CURRENTLY DESCRIBED

 ENTER YOUR SELECTION -> 0
EXIT FROM TRUCK AND SHOVEL ROUTINES ?(YES OR NO) NO
```

Figure 53. Cycling on to the next land use - truck and shovel spoils grading.

```
** TRUCK AND SHOVEL SEGMENT - WAT.REC. ALTERNATIVE **

USE SAME INITIAL DATA AS FOR WILDLIFE ? NO

INPUT WALL/BENCH INFORMATION :

> BEGIN WITH BOTTOM HIGHWALL AND BENCH
  PROCEEDING UPWARD UNTIL DONE

> WHEN DONE, ENTER ZERO FOR THE HEIGHT
  OF WHAT WOULD HAVE BEEN THE NEXT HIGHWALL

> 10 HIGHWALL//BENCH PAIRS ARE ALLOWED

> WIDTH OF TOP BENCH CAN BE NO GREATER
  THAN ONE HALF THE WIDTH OF THE HILL TOP


NOW DESCRIBING HIGHWALL/BENCH  PAIR # 1

VERTICAL HEIGHT OF HIGHWALL (FEET) ->  35
WIDTH OF THE BENCH (FEET) -> 200
INITIAL SLOPE OF THE HIGHWALL (DEGREES) -> 34
LENGTH OF BENCH ALONG OUTSIDE EDGE (FEET) -> 1000
```

Figure 54. Reinputting basic highwall/bench data for the water-based recreation option.

```
              *** CURRENT HIGHWALL/BENCH DATA ***

PAIR #  HW HEIGHT  HW SLOPE  BENCH WIDTH  BENCH LENGTH
------  ---------  --------  -----------  ------------

 1         35.00     34.00       200.00        1000.00
 2         35.00     34.00       200.00        1000.00
 3         35.00     34.00       200.00        1000.00

HIGHWALL/BENCH PAIR NUMBER OF EDIT (0 TO QUIT)->0

   BENCH LENGTH  2 'S VALUE OF     1000.000 FEET
   HAS BEEN ADJUSTED TO     2259.511 FEET

   BENCH LENGTH  1 'S VALUE OF     1000.000 FEET
   HAS BEEN ADJUSTED TO     3519.021 FEET

   HIT THE RETURN KEY TO CONTINUE ....
```

Figure 55. Summary table of new input data for the water-based recreation option, along with bench length adjustments.

```
*** CURRENT HIGHWALL/BENCH DATA ***

PAIR #  HW HEIGHT  HW SLOPE  BENCH WIDTH  BENCH LENGTH
------  ---------  --------  -----------  ------------

 1        35.00     34.00       200.00       3519.02
 2        35.00     34.00       200.00       2259.51
 3        35.00     34.00       200.00       1000.00

HIGHWALL/BENCH PAIR NUMBER OF EDIT (0 TO QUIT)->0

   HIT THE RETURN KEY TO CONTINUE ....
```

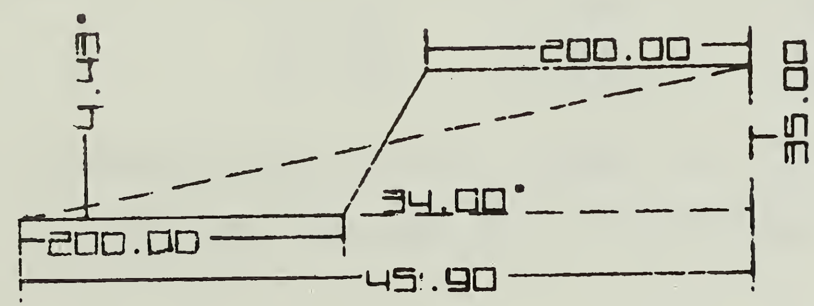
Figure 56. Input of computer-corrected bench lengths, semicircular spoils.

```
READY TO INPUT FINAL SLOPES.
 1 -> GRAPHIC MODE
 2 -> NON - GRAPHIC MODE
ENTER YOUR SELECTION -> 1
```

Figure 57. Selection of the graphic mode for final grading - truck and shovel spoils.

INPUT FINAL SLOPES : WAT.REC. ALTERNATIVE

MINIMUM REQUESTABLE SLOPE



--------------------HIGHWALL # 1--------------------

WE RECOMMEND A FINAL SLOPE VALUE OF 8.00 DEGREES.
THE CURRENT MINIMUM SLOPE OF 4.43 DEGREES WILL RESULT
IN A TERRACE # 1 WIDTH OF ABOUT ZERO.
THE MAXIMUM REQUESTABLE SLOPE IS -> 19.00 DEGREES

INPUT THE FINAL SLOPE (DEGREES) DESIRED ON HIGHWALL 1 -> 8

Figure 58. Graphic display of the minimum final slope for highwall #1, with final slope recommendations for the water-based recreation land use.

vary from drawing to drawing. In all cases, the vertical scale is magnified 3 times over the horizontal, so that the vertical heights and values will be more readily seen.

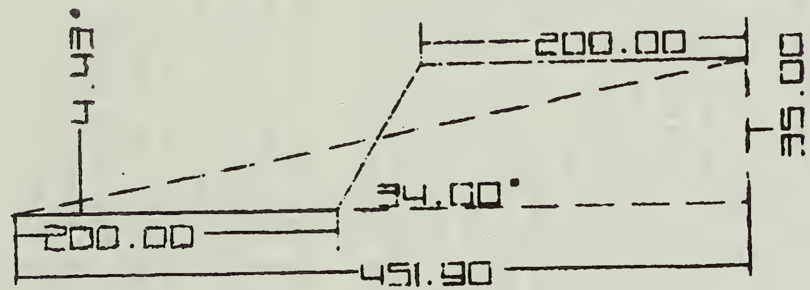
For the water-based recreation land use, the user is given a recommended array of final slope values, which may be changed within limits by the user. After the user specifies the final slope desired (Fig. 58), the computer draws this in as the new, final slope, and calculates how much of a terrace will be left on the first bench (Fig. 59). The same approach is repeated for h/b #2 (see Fig. 60 for the start of this), where the recommended, relatively steep, slopes will fit without changes being made in bench widths.

With highwall-bench #3, a relatively flat slope is recommended and used (Fig. 61). The desired slope is less than the minimum currently feasible, so the computer calculates and graphs that bench #2 will have to be increased in width to be able to accept the spoils from grading h/b #3 (Fig. 62). If the user, for some reason, does not want to increase the width of bench #2, he may re-enter his final slope (a steeper slope would be required), or he may exit from the whole grading routine, which will shift him back to the list of edit options, where he may reinput all h/b data (Fig. 53 - option 6). When the user elects to implement the bench width increase, the computer recalculates the new arc length of that bench, and all those below it. This in turn results in a new lengthening of these benches, so they may meet the hillside at the same angle (Fig. 63). After this, the new bench #2 is shown as a solid line (Fig. 64), and the user is advised as to the new minimum slope that it may be graded to - which will correspond to the final slope the user originally requested. The user is then asked to input his desired, originally infeasible slope as a final graded slope. At this point, if the user would exceed a set default slope (such as 5.7 degrees for cropland), he would receive an error message, and would be asked to reinput the slope at a value less than or equal to the default maximum. When the user inputs his desired slope, the computer draws this in as a final slope, and calculates the terrace widths that are left below and above the slope (Fig. 65).

After the final slopes are entered for water-based recreation, the computer cycles to the high use option, which is the last of the 5 major options. After entering the same data as used in the preceding, water recreation, option (Fig. 66), the user obtains the default values (Fig. 67) as before. This time, however, they will not all automatically fit when using the same initial slopes. The user may use the computer's suggestion to make a bench "gradable" (Fig. 68), and will again receive a bench length correction (Fig. 69). For h/b #3, a final slope flatter than 11.5 was manually input (not shown). Since it would not fit, the

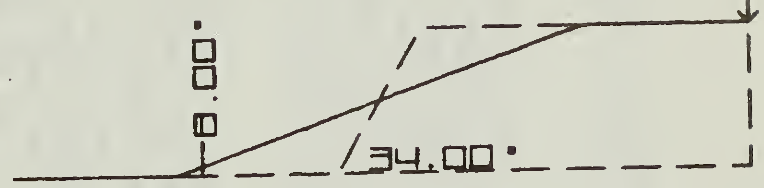
INPUT FINAL SLOPES : WAT.REC. ALTERNATIVE

MINIMUM REQUESTABLE SLOPE



FINAL SLOPE VALUE

TERRACE # 1 WIDTH IS 101.4'



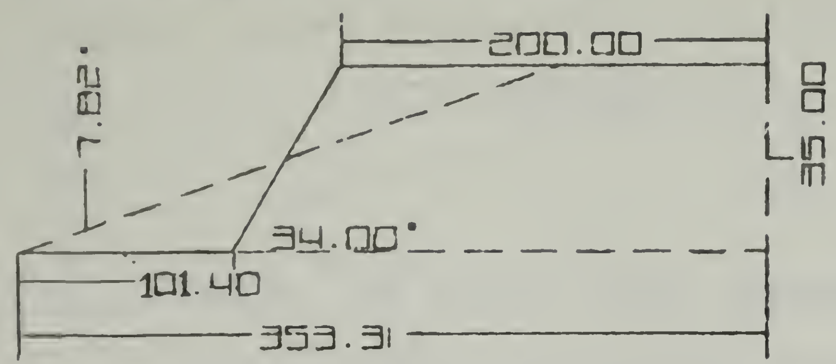
--------------------HIGHWALL # 1--------------------

```
WE RECOMMEND A FINAL SLOPE VALUE OF    8.00 DEGREES.
     THE CURRENT MINIMUM SLOPE OF    4.43 DEGREES WILL RESULT
     IN A TERRACE #  1 WIDTH OF ABOUT ZERO.
     THE MAXIMUM REQUESTABLE SLOPE IS ->    19.00 DEGREES

     INPUT THE FINAL SLOPE (DEGREES) DESIRED ON HIGHWALL  1 -> 8
```

HIT RETURN KEY TO ERASE AND CONTINUE....

Figure 59. Computer drawing of final slope desired on h/b #1, and calculation of the final terrace width.

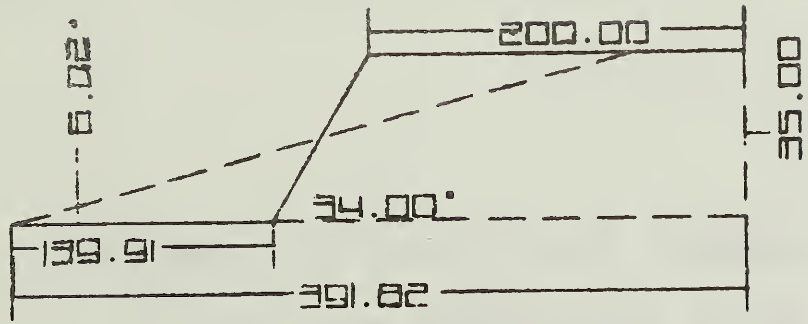
MINIMUM REQUESTABLE SLOPE




```
                    --------------------HIGHWALL #  2--------------------

WE RECOMMEND A FINAL SLOPE VALUE OF    11.50 DEGREES.
       THE CURRENT MINIMUM SLOPE OF     7.83 DEGREES WILL RESULT
       IN A TERRACE #  1 WIDTH OF ABOUT ZERO.
       THE MAXIMUM REQUESTABLE SLOPE IS ->    19.00 DEGREES

       INPUT THE FINAL SLOPE (DEGREES) DESIRED ON HIGHWALL  2 -> 11.5
```

Figure 60. Minimum gradable slope for h/b #2, with final slope recommendations.

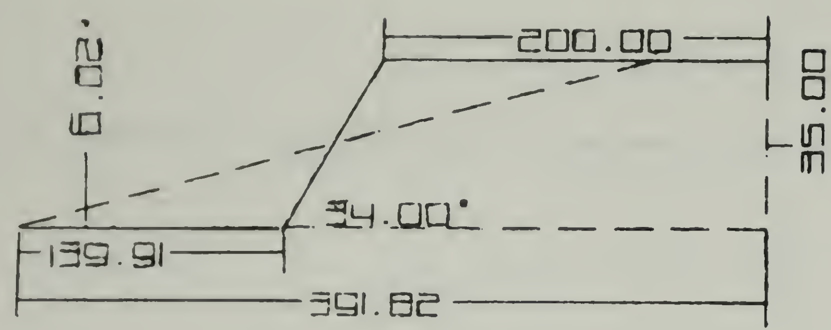
MINIMUM REQUESTABLE SLOPE



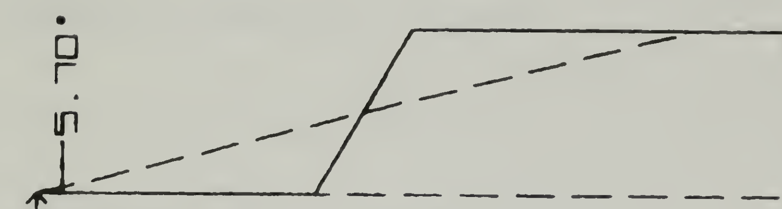

```
--------------------HIGHWALL #  3--------------------

WE RECOMMEND A FINAL SLOPE VALUE OF    5.70 DEGREES.
       THE CURRENT MINIMUM SLOPE OF    6.02 DEGREES WILL RESULT
       IN A TERRACE #  2 WIDTH OF ABOUT ZERO.
       THE MAXIMUM REQUESTABLE SLOPE IS ->    19.00 DEGREES

       INPUT THE FINAL SLOPE (DEGREES) DESIRED ON HIGHWALL  3 -> 5.7
```

Figure 61. Minimum gradable slope for h/b #3, with final slope recommendations.

MINIMUM REQUESTABLE SLOPE



SUGGESTED BENCH ADJUSTMENT(S)



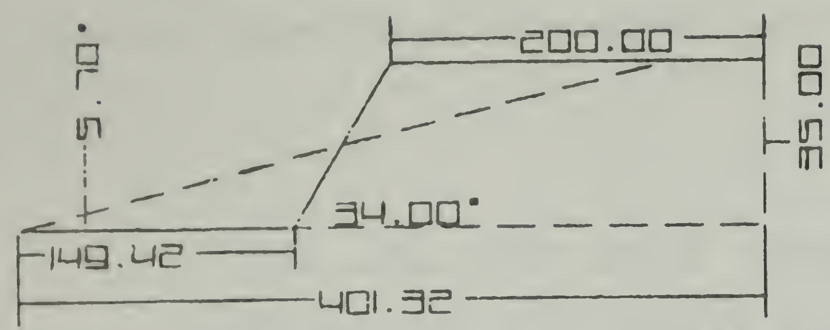

```
---------------------HIGHWALL #  3--------------------

WE RECOMMEND A FINAL SLOPE VALUE OF     5.70 DEGREES.
       THE CURRENT MINIMUM SLOPE OF     6.02 DEGREES WILL RESULT
       IN A TERRACE #  2 WIDTH OF ABOUT ZERO.
       THE MAXIMUM REQUESTABLE SLOPE IS ->     19.00 DEGREES

       INPUT THE FINAL SLOPE (DEGREES) DESIRED ON HIGHWALL  3 -> 5.7

     SUGGESTED BENCH INCREASES FOR GRADING
    THIS HIGHWALL DOWN TO YOUR SLOPE VALUE
    ARE DISPLAYED IN THE UPPER RIGHT CORNER.

     YOU MAY:
     1 -> IMPLEMENT THE BENCH INCREASES
     2 -> RE - ENTER THE FINAL SLOPE
     3 -> EXIT FROM THIS ROUTINE
     INPUT -> 1
```

Figure 62. Suggested increase in bench width #2 to accommodate grading of h/b #3.

```
BENCH LENGTH  1 'S VALUE OF     3519.021 FEET
HAS BEEN ADJUSTED TO     3566.524 FEET

BENCH LENGTH  2 'S VALUE OF     2259.511 FEET
HAS BEEN ADJUSTED TO     2307.013 FEET

BENCH LENGTH  3 'S VALUE OF     1000.000 FEET
HAS BEEN ADJUSTED TO     1000.000 FEET

HIT THE RETURN KEY TO CONTINUE ....
```

Figure 63. Readjustment of the bench lengths in response to widening of a bench.

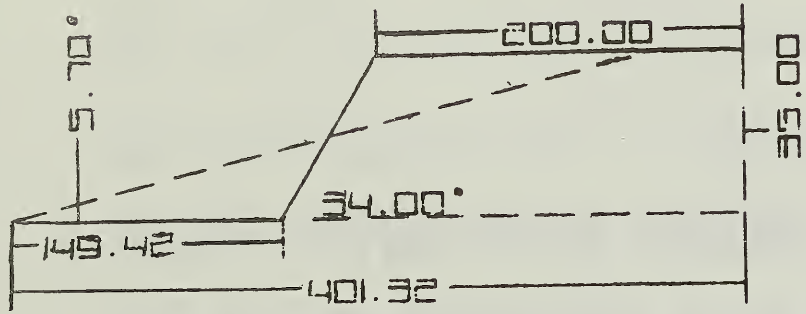
MINIMUM REQUESTABLE SLOPE



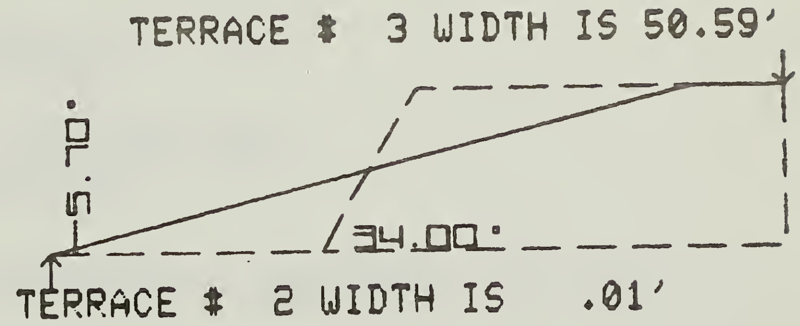

```
--------------------HIGHWALL #  3--------------------

WE RECOMMEND A FINAL SLOPE VALUE OF      5.70 DEGREES.
      THE CURRENT MINIMUM SLOPE OF       5.70 DEGREES WILL RESULT
      IN A TERRACE #  2 WIDTH OF ABOUT ZERO.
      THE MAXIMUM REQUESTABLE SLOPE IS ->     19.00 DEGREES

      INPUT THE FINAL SLOPE (DEGREES) DESIRED ON HIGHWALL  3 -> 5.7
```

Figure 64. Input of final desired slope for h/b #3, after bench width adjustments have been made to bench #2.

MINIMUM REQUESTABLE SLOPE



FINAL SLOPE VALUE




```
--------------------HIGHWALL #  3--------------------

WE RECOMMEND A FINAL SLOPE VALUE OF      5.70 DEGREES.
       THE CURRENT MINIMUM SLOPE OF      5.70 DEGREES WILL RESULT
       IN A TERRACE #  2 WIDTH OF ABOUT ZERO.
       THE MAXIMUM REQUESTABLE SLOPE IS ->     19.00 DEGREES

       INPUT THE FINAL SLOPE (DEGREES) DESIRED ON HIGHWALL  3 -> 5.7
```

Figure 65. Final desired slope accepted with calculation of upper and lower terrace widths.

HIT RETURN KEY TO ERASE AND CONTINUE....

```
** TRUCK AND SHOVEL SEGMENT - HIGH USE ALTERNATIVE **
USE SAME INITIAL DATA AS FOR WAT.REC. ? YES
```

Figure 66. Re-use of the input data from the preceding land use.

```
*** INPUT FINAL SLOPES ***


 * HIGH USE ALTERNATIVE  *

DEFAULT SLOPES :
HIGHWALL/BENCH PAIR   DEFAULT SLOPE VALUE
-------------------    -------------------

         1                     5.70
         2                     8.00
         3                    11.50

SELECT ONE OF THE FOLLOWING :
1) USE THE DEFAULT VALUES
2) I'LL USE MY OWN VALUES
ENTER 1 OR 2 -> 1

THE DEFAULT SLOPE VALUE OF  8.00 DEGREES FOR
HIGHWALL  2 WILL NOT FIT. THE CURRENT MINIMUM FOR
THIS HIGHWALL IS 12.88 DEGREES


SELECT ONE OF THE FOLLOWING OPTIONS :
1) LET ME USE MY OWN VALUE
2) GIVE ME A SUGGESTION THAT WILL ENABLE
   ME TO USE THE DEFAULT VALUE
3) GET ME OUT OF HERE
ENTER YOUR CHOICE HERE -> 2
```

Figure 67. High use alternative default slopes, with one that will not fit.

```
SUGGESTION :

IF YOU INCREASE BENCH  1 FROM  200.00 FEET , TO

 248.00 FEET, THE FINAL SLOPE VALUE OF  8.00 DEGREES

WILL WORK.  YOU MAY :

1) IMPLEMENT THE ABOVE SUGGESTION

2) INCREASE THE BENCH ACCORDING TO YOUR OWN SPECIFICATIONS

3) INPUT A DIFFERENT SLOPE VALUE

4) RE-INPUT ALL FINAL SLOPES FOR THIS ALTERNATIVE

5) EXIT FROM THIS ROUTINE

ENTER YOUR SELECTION HERE -> 2

INPUT BENCH  1'S NEW VALUE -> 250
```

Figure 68. Computer suggestion for adjusting the #1 bench width so that an upper slope may be graded.

```
BENCH LENGTH  1 'S VALUE OF      3566.524 FEET
HAS BEEN ADJUSTED TO      3816.524 FEET

HIT THE RETURN KEY TO CONTINUE ....
```

Figure 69. Re-adjustment of #1 bench length in response to a changed bench width.

computer provided advice on how to widen bench #2. If the user does not wish to use the computer's bench width calculation, he may insert his own, if it is at least as wide as the minimum required. Fig. 70 shows where several widths were input for bench #2 and #3, until one was acceptable for each.

At this point, all initial and final h/b data have been entered in for the last land use option. The user is returned to the edit option, where he may choose to look at a summary of the grading volumes and costs for these data (Fig. 71). He may elect to get a summary table only (Figs. 72, 73), or he may receive a summary table with a cross sectional view of the initial and final graded spoils (Fig. 74). It should be remembered, that there is a separate summary table for each land use. The user should review each summary table before he proceeds to the next land use option, because the table cannot be retrieved later.

This same rule applies to all the other edit options - any changes desired must be made before proceeding to the next land use. Figure 75 shows a change being made to the spoils rehandle data. This edit is available only for the mine run and final pit truck and shovel spoils, which will be explained further under those headings, in this section.

In Fig. 76, an edit was made to the spoil pile configuration. In this case, the change was from rectangular to semi-circular spoils. Once this is done, the computer must adjust the bench lengths for the semi-circular hill (Fig. 77). If the user changes from semi-circular spoils to rectangular spoils, no bench length changes will be made by the computer. However, the acreage will increase, because the rectangle covers more area than the arc having the same outside bench length.

When the user elects to make selective changes to the initial highwall/bench data that he input (Fig. 78), he is first asked which h/b pair he desires to consider (Fig. 79). He then may make specific changes to the highwall or bench (Fig. 80), but these must be within geometrical constraints imposed by h/b pairs that are above or below the one being modified. In Fig. 80, an increase to a highwall height was made that would not fit. Usually, a lesser value than the current height will fit. Figure 81 shows an edit being made to a bench width. It should be recognized that the "current" bench width was determined through the interactive process when grading needs for that land use were being analyzed. The very first value was 200 feet, but this was changed to 298.8 feet. If the user increases a bench width, as in Fig. 81, prior grading constraints are not violated. If a bench width is decreased, it often will not fit. The width change in Fig. 81 was made to rectangular spoils, so no bench length correction was made by the computer.

```
SUGGESTION :                                 INPUT BENCH  3'S NEW VALUE -> 500
                                 0
IF YOU INCREASE BENCH  2 FROM  298.82 FEET, TO
 615.86 FEET, AND INCREASE BENCH  3 FROM  298.82 FEET, TO
 475.28 FEET, WE CAN USE THE SLOPE VALUE FOR HIGHWALL  3


YOU CAN :
1) IMPLEMENT THE ABOVE SUGGESTION
2) USE YOUR OWN BENCH ADJUSTMENTS
3) INPUT A DIFFERENT SLOPE VALUE
4) RE-INPUT ALL FINAL SLOPES FOR THIS ALTERNATIVE
5) EXIT FROM THIS OPTION
ENTER YOUR CHOICE HERE -> 2
INPUT BENCH  2'S NEW VALUE -> 200
INPUT BENCH  2'S NEW VALUE -> 300
INPUT BENCH  2'S NEW VALUE -> 700
INPUT BENCH  3'S NEW VALUE -> 200
INPUT BENCH  3'S NEW VALUE -> 400
```

Figure 70. Manual input of new bench widths until the minimum value required is reached.

```
*** EDIT  OPTIONS ***

0 -> EXIT FROM THIS LAND USE OPTION

1 -> DISPLAY SUMMARY TABLE OF VOLUME AND COST CALCULATIONS

2 -> EDIT REHANDLE DATA  [ NOT FOR OPENING CUT ]

3 -> EDIT THE SPOIL PILE CONFIGURATION CODE

4 -> SCHEDULE SELECTIVE CHANGES TO INITIAL
     HIGHWALL / BENCH DATA

5 -> SCHEDULE SELECTIVE CHANGES TO FINAL SLOPES

6 -> RE - INPUT ALL INITIAL HIGHWALL / BENCH DATA

7 -> RE - INPUT ALL FINAL SLOPE VALUES

8 -> EDIT THE COST OF GRADING OVERBURDEN
     AND RE-COMPUTE ALL COSTS FOR ALL LAND
     USE OPTIONS CURRENTLY DESCRIBED

ENTER YOUR SELECTION -> 1
```

Figure 71. Choosing option #1 - review of final grading volumes and costs.

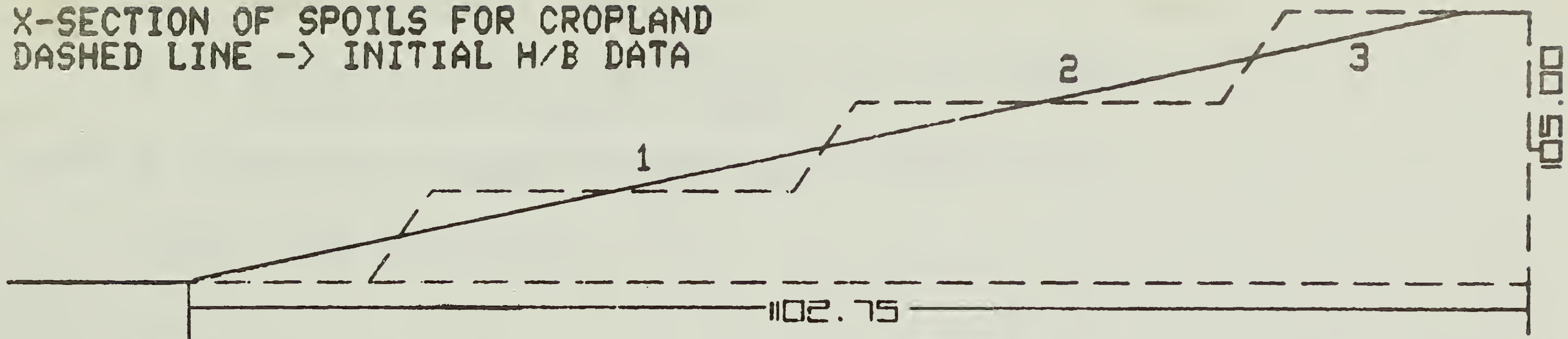
```
** DISPLAY SUMMARY TABLE **

1 -> PRESENT CROSS - SECTIONAL VIEW OF GRADED
     SPOILS WITH SUMMARY TABLE

2 -> PRESENT SUMMARY TABLE ONLY

ENTER YOUR SELECTION -> 2
```

Figure 72. Choice of summary calculations in tabular form.

```
1
                  ***** CROPLAND ALTERNATIVE *****
 TRUCK & SHOVEL GRADING                            OPENING CUT OPTION
 ----------------------------------------------------------------------
 H/B *HW SLOPES-DEG* BENCHES  (FT) * HW HGT *BEN LEN*VOL GRADED*      *
 NO. *INITIAL*FINAL*INITIAL* FINAL * (FEET) * (FEET) *  (CU YDS) * COST*
 ----------------------------------------------------------------------
   1 *34.00  * 5.70*298.8  *   .0 *  35.0  *4507.2 * 133487.7 *33371.9 *
   2 *34.00  * 5.70*298.8  *   .0 *  35.0  *2753.6 * 163980.5 *40995.1 *
   3 *34.00  * 5.70*200.0  * 50.6 *  35.0  *1000.0 *  79071.2 *19767.8 *
 ----------------------------------------------------------------------

     TOTAL VOLUME GRADED            :     376539.4  CUBIC YARDS.
     COST PER CU. YD    OF GRADING:          25.0  CENTS.
     TOTAL COST OF GRADING          : $   94134.86
     AREA  COVERED BY SPOILS        :         69.8  ACRES.
     COST PER ACRE OF GRADING       : $    1348.78

HIT RETURN KEY TO ERASE AND CONTINUE...
```

Figure 73. Summary table of volume and costs for the cropland option.

X-SECTION OF SPOILS FOR CROPLAND
DASHED LINE -> INITIAL H/B DATA



H/B NO.	HW SLOPES-DEG INITIAL:FINAL	BENCHES (FT) INITIAL:FINAL	HW HGT (FEET)	BEN LEN (FEET)	VOL GRADED (CU YDS)	COST
1	34.0: 5.7	298.8: .0	35.0	4507.2	133487.7	33371.93
2	34.0: 5.7	298.8: .0	35.0	2753.6	163980.5	40995.13
3	34.0: 5.7	200.0: 50.6	35.0	1000.0	79071.2	19767.79
				TOTALS:	376539.4	94134.86

REHANDLE VOLUME : .00 CUBIC YARDS
REHANDLE COST : .00 CENTS PER CUBIC YARD
REHANDLE TOTAL : .00 DOLLARS

AREA COVERED BY GRADED SPOILS : 69.79 ACRES
REHANDLE COST PER ACRE : .00 DOLLARS
GRADING COST PER ACRE : 1348.78 DOLLARS
***** GRAND TOTAL COST PER ACRE IS 1348.78 DOLLARS *****
PLOTTER COPY ? (YES OR NO) ->NO

Figure 74. Summary table and graph for the cropland option.

```
 *** EDIT  OPTIONS ***

0 -> EXIT FROM THIS LAND USE OPTION

1 -> DISPLAY SUMMARY TABLE OF VOLUME AND COST CALCULATIONS

2 -> EDIT REHANDLE DATA  [ NOT FOR OPENING CUT ]

3 -> EDIT THE SPOIL PILE CONFIGURATION CODE

4 -> SCHEDULE SELECTIVE CHANGES TO INITIAL
     HIGHWALL / BENCH DATA

5 -> SCHEDULE SELECTIVE CHANGES TO FINAL SLOPES

6 -> RE - INPUT ALL INITIAL HIGHWALL / BENCH DATA

7 -> RE - INPUT ALL FINAL SLOPE VALUES

8 -> EDIT THE COST OF GRADING OVERBURDEN
     AND RE-COMPUTE ALL COSTS FOR ALL LAND
     USE OPTIONS CURRENTLY DESCRIBED

 ENTER YOUR SELECTION -> 2

REHANDLE INFORMATION :
1 -> REHANDLE VOLUME IS      ->  100000.0 CUBIC YARDS
2 -> REHANDLE COST IS        ->      65.0 CENTS/CU. YD.

ENTER THE ITEM YOU WISH TO CHANGE (0 TO QUIT) -> 1

TOTAL VOLUME OF REHANDLE (CU.YDS) -> 10000
```

Figure 75. Editing the spoils rehandle data for mine run and final pit spoils.

```
 *** EDIT  OPTIONS ***

 0 -> EXIT FROM THIS LAND USE OPTION

 1 -> DISPLAY SUMMARY TABLE OF VOLUME AND COST CALCULATIONS

 2 -> EDIT REHANDLE DATA  [ NOT FOR OPENING CUT ]

 3 -> EDIT THE SPOIL PILE CONFIGURATION CODE

 4 -> SCHEDULE SELECTIVE CHANGES TO INITIAL
      HIGHWALL / BENCH DATA

 5 -> SCHEDULE SELECTIVE CHANGES TO FINAL SLOPES

 6 -> RE - INPUT ALL INITIAL HIGHWALL / BENCH DATA

 7 -> RE - INPUT ALL FINAL SLOPE VALUES

 8 -> EDIT THE COST OF GRADING OVERBURDEN
      AND RE-COMPUTE ALL COSTS FOR ALL LAND
      USE OPTIONS CURRENTLY DESCRIBED

 ENTER YOUR SELECTION -> 3

INPUT SPOIL PILE CONFIGURATION CODE :
1-> SEMI-CIRCULAR SPOILS
2-> RECTANGULAR SPOILS
ENTER CONFIGURATION BEST DESCRIBING SPOILS -> 1
```

Figure 76. Editing the spoil pile configuration from rectangular to semi-circular.

```
*** CURRENT HIGHWALL/BENCH DATA ***

PAIR #   HW HEIGHT   HW SLOPE   BENCH WIDTH   BENCH LENGTH
------   ---------   --------   -----------   ------------

  1        35.00       34.00       298.82        1000.00
  2        35.00       34.00       298.82        1000.00
  3        35.00       34.00       200.00        1000.00

HIGHWALL/BENCH PAIR NUMBER OF EDIT(0 TO QUIT) ->0

   BENCH LENGTH  2 'S VALUE OF      1000.000 FEET
   HAS BEEN ADJUSTED TO      2753.605 FEET

   BENCH LENGTH  1 'S VALUE OF      1000.000 FEET
   HAS BEEN ADJUSTED TO      4507.210 FEET

   HIT THE RETURN KEY TO CONTINUE ....
```

Figure 77. Adjustment of bench lengths for semi-circular spoils.

```
 *** EDIT  OPTIONS ***

0 -> EXIT FROM THIS LAND USE OPTION

1 -> DISPLAY SUMMARY TABLE OF VOLUME AND COST CALCULATIONS

2 -> EDIT REHANDLE DATA  [ NOT FOR OPENING CUT ]

3 -> EDIT THE SPOIL PILE CONFIGURATION CODE

4 -> SCHEDULE SELECTIVE CHANGES TO INITIAL
     HIGHWALL / BENCH DATA

5 -> SCHEDULE SELECTIVE CHANGES TO FINAL SLOPES

6 -> RE - INPUT ALL INITIAL HIGHWALL / BENCH DATA

7 -> RE - INPUT ALL FINAL SLOPE VALUES

8 -> EDIT THE COST OF GRADING OVERBURDEN
     AND RE-COMPUTE ALL COSTS FOR ALL LAND
     USE OPTIONS CURRENTLY DESCRIBED

ENTER YOUR SELECTION -> 4
```

Figure 78. Selecting edit option 4 for truck and shovel spoils.

```
WHICH HIGHWALL/BENCH PAIR DO YOU WISH TO CONSIDER ?
(ENTER A NUMBER BETWEEN 1 AND  3 OR ZERO TO QUIT -> 2
```

Figure 79. Choice of h/b pair in editing initial input data.

```
WHERE IS YOUR CHANGE ON WALL/BENCH # 2 ?
0 -> NO FURTHER CHANGES
1 -> HIGHWALL HEIGHT
2 -> BENCH WIDTH
3 -> INITIAL SLOPE OF THE HIGHWALL
4 -> LENGTH OF THE BENCH

ENTER YOUR CHOICE HERE ->  1

CURRENT HEIGHT =    35.00 FEET
ENTER YOUR NEW HEIGHT HERE -> 40

ERROR -> NOT ENOUGH ROOM ON BENCH  1
FOR THAT HEIGHT IN COMBINATION WITH THE BENCH WIDTH
AND THE PREVIOUSLY REQUESTED FINAL SLOPES. TRY AGAIN.
```

Figure 80. Change to a highwall height, which would not fit.

```
WHERE IS YOUR CHANGE ON WALL/BENCH # 2 ?
0 -> NO FURTHER CHANGES
1 -> HIGHWALL HEIGHT
2 -> BENCH WIDTH
3 -> INITIAL SLOPE OF THE HIGHWALL
4 -> LENGTH OF THE BENCH

ENTER YOUR CHOICE HERE ->  2

CURRENT BENCH WIDTH =  298.82FEET
ENTER YOUR NEW BENCH WIDTH HERE -> 350
```

Figure 81. Changing the initial bench width on h/b #2.

The user also may make selective changes to final graded slopes (Fig. 82). The computer reminds the user as to the land use option, and calculates the minimum slope which may be achieved (Fig. 83). If the user has already laid out cropland benches so that no terraces are left over after grading, then there is no flexibility left to grade any slopes flatter. Also, in the cropland land use, the 5.7 degree value cannot be exceeded. Therefore, the minimum and maximum slope possible are the same (5.7 degrees). A lesser slope can be accommodated by widening the bench. If the user did not complete his entry of final slopes in the data input section, and then exited to the edit options, this option (5) sets all h/b slopes back to their original, ungraded input values, and makes minimum slope grading recommendations accordingly - as shown in Fig. 83.

In some cases, the user may want to start over for a particular land use. He may do this by selecting edit option 6 (Fig. 84) - "Re-input all initial highwall/bench data". The computer will then begin to cycle through the benches, asking for the data (Fig. 85) as was done originally.

If the user desires to input all final slopes (Fig. 86) he will be started over in the procedure described previously (see Fig. 42). However, the "slate is not wiped clean" altogether. All h/b width and length adjustments that were made previously are retained, and these must be changed interactively, as before, to obtain the final desired topography.

The last kind of edit allowed for the truck and shovel spoils grading is a relatively simple change to the cost per cubic yard of grading spoils (Fig. 87). The new value is used for all further cost calculations in the grading routines and in TECON and OPUSE.

When the user has input all initial and final h/b data, and has done any necessary edits, for all land use options he desires, he exits from the truck and shovel routines (Fig. 88). At this time, all necessary truck and shovel data have been input under option 1 of the CLAIM data input executive, and the computer then records which of the land uses have received grading parameters (Fig. 89). If desired, the user may proceed directly to entering environmental data from here, without having to select option 3 from the data input executive (Fig. 89). If general description data are not complete, a message to this effect is presented (Fig. 90).

```
 *** EDIT  OPTIONS ***

0 -> EXIT FROM THIS LAND USE OPTION

1 -> DISPLAY SUMMARY TABLE OF VOLUME AND COST CALCULATIONS

2 -> EDIT REHANDLE DATA  [ NOT FOR OPENING CUT ]

3 -> EDIT THE SPOIL PILE CONFIGURATION CODE

4 -> SCHEDULE SELECTIVE CHANGES TO INITIAL
     HIGHWALL / BENCH DATA

5 -> SCHEDULE SELECTIVE CHANGES TO FINAL SLOPES

6 -> RE - INPUT ALL INITIAL HIGHWALL / BENCH DATA

7 -> RE - INPUT ALL FINAL SLOPE VALUES

8 -> EDIT THE COST OF GRADING OVERBURDEN
     AND RE-COMPUTE ALL COSTS FOR ALL LAND
     USE OPTIONS CURRENTLY DESCRIBED

ENTER YOUR SELECTION -> 5
```

Figure 82. Selective change desired for the final graded slope.

```
CROPLAND ALTERNATIVE


WHICH HIGHWALL/BENCH PAIR NUMBER DO YOU WISH
TO CONSIDER ? (ENTER 1 TO  3 OR ZERO TO QUIT) -> 3

MINIMUM SLOPE REQUESTABLE IS  4.42 DEGREES
BENCHES  2 AND  3 WILL BE APPROXIMATELY ZERO.

FINAL SLOPE FOR HIGHWALL #  3 -> 0

ERROR -> SLOPE MUST BE BETWEEN  4.42 DEGREES,
AND  5.70 DEGREES. TRY AGAIN ? (YES OR NO) -> YES

FINAL SLOPE FOR HIGHWALL #  3 -> 5

WHICH HIGHWALL/BENCH PAIR NUMBER DO YOU WISH
TO CONSIDER ? (ENTER 1 TO  3 OR ZERO TO QUIT) -> 0
```

Figure 83. Selection of h/b pair for final slope modification, with cropland slope limit.

```
 *** EDIT  OPTIONS ***

0 -> EXIT FROM THIS LAND USE OPTION

1 -> DISPLAY SUMMARY TABLE OF VOLUME AND COST CALCULATIONS

2 -> EDIT REHANDLE DATA  [ NOT FOR OPENING CUT ]

3 -> EDIT THE SPOIL PILE CONFIGURATION CODE

4 -> SCHEDULE SELECTIVE CHANGES TO INITIAL
     HIGHWALL / BENCH DATA

5 -> SCHEDULE SELECTIVE CHANGES TO FINAL SLOPES

6 -> RE - INPUT ALL INITIAL HIGHWALL / BENCH DATA

7 -> RE - INPUT ALL FINAL SLOPE VALUES

8 -> EDIT THE COST OF GRADING OVERBURDEN
     AND RE-COMPUTE ALL COSTS FOR ALL LAND
     USE OPTIONS CURRENTLY DESCRIBED

ENTER YOUR SELECTION -> 6
```

Figure 84. Starting over for a certain land use grading - through the edit option 6.

```
** TRUCK AND SHOVEL SEGMENT - CROPLAND ALTERNATIVE **

INPUT WALL/BENCH INFORMATION :

> BEGIN WITH BOTTOM HIGHWALL AND BENCH
  PROCEEDING UPWARD UNTIL DONE

> WHEN DONE, ENTER ZERO FOR THE HEIGHT
  OF WHAT WOULD HAVE BEEN THE NEXT HIGHWALL

> 10 HIGHWALL//BENCH PAIRS ARE ALLOWED

> WIDTH OF TOP BENCH CAN BE NO GREATER
  THAN ONE HALF THE WIDTH OF THE HILL TOP


NOW DESCRIBING HIGHWALL/BENCH  PAIR # 1

VERTICAL HEIGHT OF HIGHWALL (FEET) ->  0
```

Figure 85. Return to h/b #1 for the re-input of initial h/b data.

```
 *** EDIT  OPTIONS ***

0 -> EXIT FROM THIS LAND USE OPTION

1 -> DISPLAY SUMMARY TABLE OF VOLUME AND COST CALCULATIONS

2 -> EDIT REHANDLE DATA  [ NOT FOR OPENING CUT ]

3 -> EDIT THE SPOIL PILE CONFIGURATION CODE

4 -> SCHEDULE SELECTIVE CHANGES TO INITIAL
     HIGHWALL / BENCH DATA

5 -> SCHEDULE SELECTIVE CHANGES TO FINAL SLOPES

6 -> RE - INPUT ALL INITIAL HIGHWALL / BENCH DATA

7 -> RE - INPUT ALL FINAL SLOPE VALUES

8 -> EDIT THE COST OF GRADING OVERBURDEN
     AND RE-COMPUTE ALL COSTS FOR ALL LAND
     USE OPTIONS CURRENTLY DESCRIBED

ENTER YOUR SELECTION -> 7
```

Figure 86. Selecting to re-input all final slope values.

```
 *** EDIT  OPTIONS ***

 0 -> EXIT FROM THIS LAND USE OPTION

 1 -> DISPLAY SUMMARY TABLE OF VOLUME AND COST CALCULATIONS

 2 -> EDIT REHANDLE DATA  [ NOT FOR OPENING CUT ]

 3 -> EDIT THE SPOIL PILE CONFIGURATION CODE

 4 -> SCHEDULE SELECTIVE CHANGES TO INITIAL
      HIGHWALL / BENCH DATA

 5 -> SCHEDULE SELECTIVE CHANGES TO FINAL SLOPES

 6 -> RE - INPUT ALL INITIAL HIGHWALL / BENCH DATA

 7 -> RE - INPUT ALL FINAL SLOPE VALUES

 8 -> EDIT THE COST OF GRADING OVERBURDEN
      AND RE-COMPUTE ALL COSTS FOR ALL LAND
      USE OPTIONS CURRENTLY DESCRIBED

     ENTER YOUR SELECTION -> 8
    CURRENT COST OF GRADING SPOILS IS ->19.00 CENTS/CUBIC YD.
ENTER THE NEW COST FOR GRADING SPOILS -> 20
```

Figure 87. New input of grading costs.

```
    *** EDIT  OPTIONS ***

    0 -> EXIT FROM THIS LAND USE OPTION

    1 -> DISPLAY SUMMARY TABLE OF VOLUME AND COST CALCULATIONS

    2 -> EDIT REHANDLE DATA  [ NOT FOR OPENING CUT ]

    3 -> EDIT THE SPOIL PILE CONFIGURATION CODE

    4 -> SCHEDULE SELECTIVE CHANGES TO INITIAL
         HIGHWALL / BENCH DATA

    5 -> SCHEDULE SELECTIVE CHANGES TO FINAL SLOPES

    6 -> RE - INPUT ALL INITIAL HIGHWALL / BENCH DATA

    7 -> RE - INPUT ALL FINAL SLOPE VALUES

    8 -> EDIT THE COST OF GRADING OVERBURDEN
         AND RE-COMPUTE ALL COSTS FOR ALL LAND
         USE OPTIONS CURRENTLY DESCRIBED

    ENTER YOUR SELECTION -> 0
EXIT FROM TRUCK AND SHOVEL ROUTINES ?(YES OR NO) YES
```

Figure 88. Exit from truck and shovel routines (CLAIM manual input of general mine description).

```
GENERAL DESCRIPTION STATUS :

GRADING PARAMETERS HAVE BEEN ENTERED FOR :

* CROPLAND ALTERNATIVE

* NAT.VEG. ALTERNATIVE

* WILDLIFE ALTERNATIVE

* WAT.REC. ALTERNATIVE

* HIGH USE ALTERNATIVE

ENVIRONMENTAL FEASIBILITY CATEGORIES HAVE
NOT BEEN ENTERED STARTING CATEGORY  2, HEADING  A

DO YOU WISH TO COMPLETE DATA ENTRIES ? NO
HIT THE RETURN KEY TO CONTINUE....
```

Figure 89. Land uses receiving grading parameters (truck and shovel) and option to proceed directly to environmental data entry.

```
GENERAL DESCRIPTION STATUS :
CATEGORY RESPONSES HAVE NOT BEEN ENTERED
STARTING HEADING A
HIT THE RETURN KEY TO CONTINUE....
```

Figure 90. Message when general mine description data are not complete.

e. Truck and shovel type mine - mine run spoils

When the user selects this stage in the truck and shovel mining sequence (Fig. 91), he is immediately asked questions about the possible rehandle volume, and cost per cubic yard for rehandling spoils (Fig. 92). These questions are asked because, at times, other spoil may have to be moved into the bottom of the pit from surrounding areas to bring the topography up to a certain minimum base elevation. An example where this may be required is when the coal seam is very thick, the overburden is very thin, and a stream channel meanders across the site. If the stream is to be replaced at its original gradient (required by law), the site must be restored to at least the original bank elevation of the stream. It would be impossible to achieve this with grading alone, so a large spoil rehandle is necessary. The CLAIM system is being developed to compute these volumes but, for now, user input of the values is required, so that total reclamation costs per acre can be calculated.

Other than these two values, data input for the mine run truck and shovel spoils is identical to the opening cut spoils. It should be remembered, however, that here the user is often dealing with a hole in the ground (made out of highwalls and benches), as well as spoil placed in a pile above the surrounding topography.

f. Truck and shovel type mine - final cut spoils

The data input for this stage in the truck and shovel mining sequence is identical to the mine run data requirements. For this stage (and at times during the mine run), the user is almost always dealing with a large pit below the surrounding surface. On some sides of the pit, the highwalls and benches will be carved out of undisturbed overburden - most likely on the property boundary. Since this material has not been previously disturbed, it is <u>subject to</u> 20-30 percent <u>swell</u> when it is blasted and graded down to the final topography. Therefore, all CLAIM grading <u>volumes and costs</u> should be <u>reduced</u> by the percentage swell factor when the system is used on these previously undisturbed sites. Likewise, recommended bench widths should be reduced by this same percentage.

2. Selecting the second option from the CLAIM data input executive (see Fig. 9) allows the user to input general mine description data all at once from a file. The file is previously built by manually inputting the data, as described above, and then storing them in a file, as described under the data storage executive, which is covered later. This option allows the user a quick, easy way to use the same mining and grading data over and over, for different sets of environmental data.

```
I.) GENERAL DESCRIPTION:  *********************************************
                          *             STANDARD EXPECTATIONS          *
                          *********************************************
                          *CROP*  NATIVE   *WILD*  WATER    *HIGH*OTHER*
                          *LAND*VEGETATION*LIFE*RECREATION*USE *     *
*******************************************************************
                          *    *           *    *           *    *     *
 B.) STAGE IN MINING      *    *           *    *           *    *     *
     SEQUENCE :           *    *           *    *           *    *     *
  1.) OPENING BOX CUT     *  1 *     1     *  2 *     1     * 1  *  0  *
  2.) MINE RUN            *  2 *     2     *  2 *     2     * 2  *  0  *
  3.) FINAL BOX CUT       *  1 *     1     *  3 *     3     * 1  *  0  *
ENTER THE APPROPRIATE     *********************************************
NUMBER, OR ZERO TO QUIT -> 2
*******************************************************************
                          *    *           *    *           *    *     *
 C.) AVERAGE SLOPE OF     *    *           *    *           *    *     *
     10 RANDOM POINTS     *    *           *    *           *    *     *
     IN THE AREA :        *    *           *    *           *    *     *
  1.)  0.00 - 3.00        *  3 *     2     *  2 *     2     * 3  *  0  *
  2.)  3.01 - 5.70        *  2 *     3     *  2 *     3     * 2  *  0  *
  3.)  5.71 - 11.50       *  0 *     2     *  3 *     2     * 1  *  0  *
ENTER THE APPROPRIATE     *********************************************
NUMBER, OR ZERO TO QUIT -> 1

     *** TRUCK AND SHOVEL MINE ***

     ENTER COST OF GRADING SPOILS(CENTS/CU.YD) -> 25
```

Figure 91. Truck and shovel mine run selection in data input mode.

```
** TRUCK AND SHOVEL SEGMENT - CROPLAND ALTERNATIVE **
TOTAL VOLUME OF REHANDLE (CU.YDS) -> 100,000
COST OF REHANDLE (CENTS/CU.YD.) -> 65
```

Figure 92. Spoils rehandle input data - truck and shovel mine run.

After selecting this option, the computer asks for the file code name, which may consist of 1-4 letters (Fig. 93). The computer finds the file on the disc storage device, presents the title (which the user created earlier), and enters it into the computer for later FEASI, TECON, and OPUSE analysis. If the user inputs a file code name that has not been stored, the computer will present an error message.

3. The third data input option, manual input of environmental data, is the heart of the data input option in CLAIM. When this is selected, the computer offers two ways of inputting data - the "full display" or the "abbreviated display" (Fig. 94). The full display method repeats each entire category, with subheadings and expectation of success values, as they appear in the databook (Fig. 95). (Heading titles may be shortened slightly so that they fit on the CRT screen.) Thus, an experienced user can enter data into the CLAIM system without using the databook.

The second means of entering data manually in CLAIM is with the abbreviated display (Fig. 96). Here, only category and heading titles appear, and the user inputs the number of the appropriate subheading, just as with the full display method. Generally, the user will be referring to his answers in the databook as he enters data in this fashion. The major advantage to this method is that data entry can be much faster, since the computer does not take time to print out the full display. With a completed databook, the user can enter in all his environmental data in this mode in only 5-10 minutes.

Complete environmental data requirements are described in the CLAIM User's Databook, and will not be repeated here. If the user does not finish the environmental data entry, a message showing where he left off is presented (Fig. 97). If all environmental data are entered, and all general mine description data are entered, the user may proceed directly to the final data analysis executive of CLAIM, which is discussed later. (These data also may be edited, reviewed, or stored, as will be discussed later.)

4. Selection of option 4 of the data input executive (Fig. 9) allows the user to input a previously-built environmental data file (Fig. 98). This offers the opportunity to combine one set of environmental data for a site with several different mine plans. File retrieval uses the same process as described previously for the general mine description file retrieval.

```
*** DATA RETRIEVAL ***

INPUT THE FILE NAME -> MINR
NOW RETRIEVING DATA FROM FILE MINR
TITLE ->YPICAL DRAGLINE MINING DATA.

HIT THE RETURN KEY TO CONTINUE ...
```

Figure 93. File input option for general mine description data.

```
******************************
*                            *
*           CLAIM            *
*                            *
*  COMPUTERIZED RECLAMATION  *
*      PLANNING SYSTEM       *
*                            *
******************************
------------
 DATA INPUT
------------

0 -> EXIT FROM DATA INPUT OPTION

1 -> MANUAL INPUT OF THE GENERAL MINE DESCRIPTION

2 -> FILE INPUT OF THE GENERAL MINE DESCRIPTION

3 -> MANUAL INPUT OF ENVIRONMENTAL DATA

4 -> FILE INPUT OF ENVIRONMENTAL DATA

5 -> FILE INPUT OF BOTH ENVIRONMENTAL DATA
     AND GENERAL MINE DESCRIPTION

6 -> MANUAL INPUT OF NON-STANDARD EXPECTATION VALUES

7 -> FILE INPUT OF NON-STANDARD EXPECTATION VALUES

8 -> INPUT TITLE TO APPEAR ON ALL OUTPUT

ENTER YOUR SELECTION -> 3
ABBREVIATED OR FULL DISPLAY ? (AD OR FD) -> FD
```

Figure 94. Manual input of environmental data, with choice of abbreviated or full category display.

INPUT RESPONSES/CLIMATOLOGY

```
II.) CLIMATOLOGY :         ********************************************
                           *          STANDARD EXPECTATIONS           *
                           ********************************************
                           *CROP*  NATIVE  *WILD*  WATER   *HIGH*OTHER*
                           *LAND*VEGETATION*LIFE*RECREATION*USE *     *
***********************************************************************
                           *    *          *    *          *    *     *
A.) AVERAGE TOTAL ANNUAL   *    *          *    *          *    *     *
    PRECIPITATION (IN)     *    *          *    *          *    *     *
  1.)  5.0-10.0            * 1  *    1     * 1  *    1     * 1  *  0  *
  2.) 10.1-15.0            * 1  *    2     * 2  *    1     * 2  *  0  *
  3.) 15.1-20.0            * 2  *    3     * 2  *    2     * 2  *  0  *
  4.) 20.1-25.0            * 3  *    3     * 3  *    3     * 2  *  0  *
ENTER THE APPROPRIATE      ********************************************
NUMBER,  OR ZERO TO QUIT ->
```

Figure 95. Full display of first climatology category for manual input of environmental data.

```
II.) CLIMATOLOGY :

A.) AVERAGE TOTAL ANNUAL
    PRECIPITATION (IN)       -> 2

 B.) AVERAGE ANNUAL WIND
    VELOCITY (MPH)           -> 2
```

Figure 96. Abbreviated display of first climatology category for manual input of environmental data.

```
ENVIRONMENTAL FEASIBILITY CATEGORIES HAVE
NOT BEEN ENTERED STARTING CATEGORY  2, HEADING  A

DO YOU WISH TO COMPLETE DATA ENTRIES ? NO
```

Figure 97. Message showing where environmental data entries have left off.

```
*** DATA RETRIEVAL ***

INPUT THE FILE NAME -> NVGO
NOW RETRIEVING DATA FROM FILE NVGO
TITLE -> NVGO FILE ** TYPICAL NORTHERN GREAT PLAINS RANGELAND SITE

HIT THE RETURN KEY TO CONTINUE ...
```

Figure 98. Retrieval of a previously built environmental data file.

5. Option 5 of the data input executive allows the user to retrieve a file, which was built before, that contains both the general mine description data and environmental data. File retrieval is the same as for both types of file separately (Fig. 99). It should be noted that the 1-4 letter code name of this file can be the same as the code name for either of the other 2 types of files. However, two files of the same type can not have the same code name.

This option is designed to let the user analyze an entire CLAIM data set very quickly. In a matter of seconds, a user may retrieve all data for a site, edit some responses if needed, then analyze the results.

6. By choosing data input option 6 (Fig. 100), the user may insert his own expectation of success values into the CLAIM system (see User's Databook for a discussion of these value's meanings). After selecting this input option, the user should refer to his databook, since the computer will then start asking questions to determine where the specific new value will be input (Fig. 101). One special feature here is that by selecting -1, the user may input expectation of success values just for the "other" category if he has some particular land use in mind (Fig. 102). This routine considerably speeds up the "other" data entry over the CLAIM data edit option.

When the user desires to make just one change to these values, he inputs the general category number, then the heading letter, and then which land use option he is interested in (Fig. 101). After this, the computer echos what has been selected, then asks for the specific expectation value to be inserted for each subheading, in order (Fig. 103). When the user has changed the desired subheadings, he may enter a -1 to quit. The computer then will ask if another land use option under the current heading will be changed. If the user does not want to do this, he enters a 0 and returns to the major category list (Fig. 101) where he may change categories or exit from the routine. If the user selects another land use (Fig. 103), the computer will echo this, and cycle through the subheading expectation values to be changed (Fig. 104). Unless stored in a file, any input changes to expectation of success values will be used only once in the immediate data analysis, and then the values will be returned to the default settings.

7. The data input executive also allows a user to enter his non-standard expectation values from a file (Fig. 105). As with the other file inputs, the new data are input manually, then stored under a 1-4 letter code name in the data storage option of the CLAIM executive. To retrieve and input the file values, the code name is entered (Fig. 106), then the system returns to the data input executive. Again, if a non-existent file code is input, an error message will be received (Fig. 107).

```
*** DATA RETRIEVAL ***

INPUT THE FILE NAME -> NUGO
NOW RETRIEVING DATA FROM FILE NUGO
TITLE -> NUGO FILE ** TYPICAL NORTHERN GREAT PLAINS RANGELAND SITE

HIT THE RETURN KEY TO CONTINUE ...
```

Figure 99. Retrieval of a file containing both general mine description and environmental data (same code name as previous environmental data file).

```
******************************
*                            *
*           CLAIM            *
*                            *
*  COMPUTERIZED RECLAMATION  *
*      PLANNING SYSTEM       *
*                            *
******************************

------------
 DATA INPUT
------------

0 -> EXIT FROM DATA INPUT OPTION

1 -> MANUAL INPUT OF THE GENERAL MINE DESCRIPTION

2 -> FILE INPUT OF THE GENERAL MINE DESCRIPTION

3 -> MANUAL INPUT OF ENVIRONMENTAL DATA

4 -> FILE INPUT OF ENVIRONMENTAL DATA

5 -> FILE INPUT OF BOTH ENVIRONMENTAL DATA
     AND GENERAL MINE DESCRIPTION

6 -> MANUAL INPUT OF NON-STANDARD EXPECTATION VALUES

7 -> FILE INPUT OF NON-STANDARD EXPECTATION VALUES

8 -> INPUT TITLE TO APPEAR ON ALL OUTPUT

ENTER YOUR SELECTION -> 6
```

Figure 100. Choosing manual input of non-standard expectation of success values.

```
*** NON-STANDARD EXPECTATION VALUES ***

 -1 -> INPUT OTHER OPTION FOR ALL CATEGORIES
       (STARTING WITH CATEGORY 1)
  0 -> EXIT FROM THIS ROUTINE
  1 -> GENERAL DESCRIPTION CATEGORY
  2 -> CLIMATOLOGY CATEGORY
  3 -> TOPSOIL CATEGORY
  4 -> SUBSOIL CATEGORY
  5 -> OVERBURDEN CATEGORY
  6 -> SURFACE WATER HYDROLOGY CATEGORY
  7 -> GROUND WATER HYDROLOGY CATEGORY
  8 -> VEGETATION CATEGORY
  9 -> ANIMALS CATEGORY
 10 -> SOCIO-ECONOMICS CATEGORY
INPUT --> 1
INPUT THE HEADING LETTER (NONE TO EXIT) -> A
LAND USE OPTION :
 1 -> CROPLAND
 2 -> NAT.VEG.
 3 -> WILDLIFE
 4 -> WAT.REC.
 5 -> HIGH USE
 6 -> OTHER
INPUT REFERENCE NUMBER (0 TO EXIT) -> 2
```

Figure 101. Input of the category, heading, and land use where the change in expectation of success value will occur.

```
    CURRENT CATEGORY IS -> GENERAL DESCRIPTION
    CURRENT HEADING  IS ->  A
    CURRENT LAND USE OPTION IS ->OTHER
    ----------------------------------------------

SUBHEADING  1 EXPECTATION VALUE (-1 TO QUIT)-> 1
SUBHEADING  2 EXPECTATION VALUE (-1 TO QUIT)-> 2
```

Figure 102. Rapid input of expectation values for the "other" land use category.

```
    CURRENT CATEGORY IS -> GENERAL DESCRIPTION
    CURRENT HEADING  IS ->  A
    CURRENT LAND USE OPTION IS ->NAT.VEG.
    ----------------------------------------

SUBHEADING  1 EXPECTATION VALUE (-1 TO QUIT)-> 3
SUBHEADING  2 EXPECTATION VALUE (-1 TO QUIT)-> 3
   LAND USE OPTION :
    1 -> CROPLAND
    2 -> NAT.VEG.
    3 -> WILDLIFE
    4 -> WAT.REC.
    5 -> HIGH USE
    6 -> OTHER
   INPUT REFERENCE NUMBER (0 TO EXIT) -> 3
```

Figure 103. Inserting new expectation of success values for the subheadings.

```
CURRENT CATEGORY IS -> GENERAL DESCRIPTION
CURRENT HEADING  IS ->  A
CURRENT LAND USE OPTION IS ->WILDLIFE
-----------------------------------------------

SUBHEADING  1 EXPECTATION VALUE (-1 TO QUIT)->
```

Figure 104. New land use choice, with new expectation value entry.

```
******************************
*                            *
*           CLAIM            *
*                            *
*  COMPUTERIZED RECLAMATION  *
*      PLANNING SYSTEM       *
*                            *
******************************
------------
 DATA INPUT
------------

0 -> EXIT FROM DATA INPUT OPTION

1 -> MANUAL INPUT OF THE GENERAL MINE DESCRIPTION

2 -> FILE INPUT OF THE GENERAL MINE DESCRIPTION

3 -> MANUAL INPUT OF ENVIRONMENTAL DATA

4 -> FILE INPUT OF ENVIRONMENTAL DATA

5 -> FILE INPUT OF BOTH ENVIRONMENTAL DATA
     AND GENERAL MINE DESCRIPTION

6 -> MANUAL INPUT OF NON-STANDARD EXPECTATION VALUES

7 -> FILE INPUT OF NON-STANDARD EXPECTATION VALUES

8 -> INPUT TITLE TO APPEAR ON ALL OUTPUT

ENTER YOUR SELECTION -> 7
```

Figure 105. Input of non-standard expectation of success values from a previously constructed file.

```
*** NON-STANDARD EXPECTATION VALUES ***
INPUT THE FILE NAME -> NSEV
```

Figure 106. File retrieval of non-standard expectation of success values.

```
*** NON-STANDARD EXPECTATION VALUES ***
INPUT THE FILE NAME -> MINR
** ERROR ** FILE MINR IS NON-EXISTENT
RE-ENTER THE FILE ? (YES OR NO) -> NO
```

Figure 107. Input of a non-existent file code name.

8. The last data input option, #8, is the ability to input a specific title on all output of CLAIM, which facilitates record-keeping. A sample title input is shown in Fig. 108. When all data are manually input, this title will always appear on all FEASI, TECON, and OPUSE output until a new title is entered, or the system is turned off. If data are entered from any file, the name of the file will appear on the output, unless option 8 is used after the file data inputs have been made.

C. Data Edit (CLAIM Executive option 2)

The second major option in the CLAIM executive is the data edit option (Fig. 109). It should be remembered that all data edits will be used in calculating FEASI, TECON, and OPUSE values. An edit to a file is only temporary. It must be stored in a new file if it is to be permanently saved.

0. Entering a 0 in the data edit option (Fig. 110) returns the user to the CLAIM executive.

1. Selection of item 1 in the data edit option allows the user to edit general mine description input data (Fig. 110). The computer then asks which category is to be edited (Fig. 111). If the user elects to change the mine type, he may do so (Fig. 112), and then he is asked to input the basic spoils grading data for that type (Fig. 113).

The user also may edit the spoils grading data that were originally set in the data input mode. If the user is dealing with a truck and shovel mine, he is asked first about what land use option to consider (Fig. 114). (The dragline routines consider all options at once.) After answering this, the user is cycled to the 8 basic edit options of the truck and shovel spoils grading routines (Fig. 115).

2. Responses to environmental data categories can be edited by selecting edit option 2 (refer to Fig. 110). The user first selects the major category (Fig. 116), then the heading, and finally inputs the specific new answer to the subheading of his choice (Fig. 117).

3. Edit option 3 allows changes to be made to the expectation of success values for the general mine description data (Fig. 110). While referring to the databook, the user first inputs the heading letter and the subheading number (Fig. 118). He then may select the proper land use, and finally the new expectation value (Fig. 119). The user is then cycled back to the heading entry level.

```
******************************
*                            *
*           CLAIM            *
*                            *
*  COMPUTERIZED RECLAMATION  *
*      PLANNING SYSTEM       *
*                            *
******************************

------------
 DATA INPUT
------------

0 -> EXIT FROM DATA INPUT OPTION

1 -> MANUAL INPUT OF THE GENERAL MINE DESCRIPTION

2 -> FILE INPUT OF THE GENERAL MINE DESCRIPTION

3 -> MANUAL INPUT OF ENVIRONMENTAL DATA

4 -> FILE INPUT OF ENVIRONMENTAL DATA

5 -> FILE INPUT OF BOTH ENVIRONMENTAL DATA
     AND GENERAL MINE DESCRIPTION

6 -> MANUAL INPUT OF NON-STANDARD EXPECTATION VALUES

7 -> FILE INPUT OF NON-STANDARD EXPECTATION VALUES

8 -> INPUT TITLE TO APPEAR ON ALL OUTPUT


ENTER YOUR SELECTION -> 8
INPUT TITLE -> TRIAL RUN #928
```

Figure 108. Input of a title for all CLAIM output.

```
******************************
*                            *
*           CLAIM            *
*                            *
*  COMPUTERIZED RECLAMATION  *
*      PLANNING SYSTEM       *
*                            *
******************************

---------
 OPTIONS
---------

0 -> TERMINATE CLAIM

1 -> DATA INPUT

2 -> DATA EDIT

3 -> CURRENT DATA REVIEW

4 -> DATA STORAGE

5 -> DATA ANALYSIS

6 -> GRADE SPOILS WITHOUT CURRENT
     LAND USE OPTION RESTRICTIONS

ENTER OPTION SELECTION -> 2
```

Figure 109. Data edit option in the CLAIM executive.

```
******************************
*                            *
*           CLAIM            *
*                            *
*  COMPUTERIZED RECLAMATION  *
*      PLANNING SYSTEM       *
*                            *
******************************
-----------
 DATA EDIT
-----------

0 -> EXIT FROM DATA EDIT OPTION

1 -> EDIT THE GENERAL MINE DESCRIPTION

2 -> EDIT RESPONSES TO ENVIRONMENTAL DATA

3 -> EDIT EXPECTATION OF SUCCESS VALUES FOR
     THE GENERAL MINE DESCRIPTION

4 -> EDIT EXPECTATION OF SUCCESS VALUES FOR
     ENVIRONMENTAL DATA

5 -> EDIT TECON COSTS


ENTER YOUR SELECTION -> 1
```

Figure 110. Data edit option executive.

```
SELECT) ONE OF THE FOLLOWING OPTIONS :
0) GET ME OUT OF HERE
1) EDIT TYPE OF MINE
2) EDIT COST TO EXCAVATE SPOIL
3) EDIT STAGE IN MINING SEQUENCE
4) EDIT SLOPE OF 10 RANDOM POINTS
5) EDIT THE SPOILS GRADING DATA
ENTER YOUR SELECTION HERE -> 1
```

Figure 111. Selection of the mine data category to be edited.

```
                  EDIT RESPONSES/GENERAL DESCRIPTION

I.) GENERAL DESCRIPTION:  ******************************************
                          *           STANDARD EXPECTATIONS          *
                          ******************************************
                          *CROP*  NATIVE   *WILD*  WATER    *HIGH*OTHER*
                          *LAND*VEGETATION*LIFE*RECREATION*USE *     *
*******************************************************************
                          *    *           *    *           *    *     *
 A.) TYPE OF MINE :       *    *           *    *           *    *     *
  1.) DRAGLINE            *  2 *     2     *  2 *     2     * 2  *  0  *
  2.) TRUCK AND SHOVEL    *  2 *     2     *  2 *     2     * 2  *  0  *
    YOUR CURRENT RESPONSE IS -> 1

    ENTER YOUR NEW RESPONSE HERE -> 2

    *** TRUCK AND SHOVEL MINE ***

    ENTER COST OF GRADING SPOILS(CENTS/CU.YD) -> 25
```

Figure 112. Changing the basic mine type.

```
** TRUCK AND SHOVEL SEGMENT - CROPLAND ALTERNATIVE **

TOTAL VOLUME OF REHANDLE (CU.YDS) -> 100,000

COST OF REHANDLE (CENTS/CU.YD.) -> 65
```

Figure 113. Inputting mine spoils grading data for the new mine type.

```
SELECT) ONE OF THE FOLLOWING OPTIONS :
0) GET ME OUT OF HERE
1) EDIT TYPE OF MINE
2) EDIT COST TO EXCAVATE SPOIL
3) EDIT STAGE IN MINING SEQUENCE
4) EDIT SLOPE OF 10 RANDOM POINTS
5) EDIT THE SPOILS GRADING DATA
ENTER YOUR SELECTION HERE -> 5

WHICH LAND USE OPTION DO YOU WISH TO CONSIDER ?
0) NONE
1) CROPLAND
2) NATIVE VEGETATION
3) WILDLIFE
4) WATER RECREATION
5) HIGH USE
ENTER YOUR CHOICE HERE -> 2
```

Figure 114. Editing spoils grading data for a truck and shovel mine.

```
*** EDIT  OPTIONS ***

0 -> EXIT FROM THIS LAND USE OPTION

1 -> DISPLAY SUMMARY TABLE OF VOLUME AND COST CALCULATIONS

2 -> EDIT REHANDLE DATA  [ NOT FOR OPENING CUT ]

3 -> EDIT THE SPOIL PILE CONFIGURATION CODE

4 -> SCHEDULE SELECTIVE CHANGES TO INITIAL
     HIGHWALL / BENCH DATA

5 -> SCHEDULE SELECTIVE CHANGES TO FINAL SLOPES

6 -> RE - INPUT ALL INITIAL HIGHWALL / BENCH DATA

7 -> RE - INPUT ALL FINAL SLOPE VALUES

8 -> EDIT THE COST OF GRADING OVERBURDEN
     AND RE-COMPUTE ALL COSTS FOR ALL LAND
     USE OPTIONS CURRENTLY DESCRIBED

ENTER YOUR SELECTION -> 0
```

Figure 115. Edit executive return to 8 edit options for truck and shovel spoils grading.

```
*** EDIT MODE ***
-----------------

0 -> EXIT

1 -> CLIMATOLOGY

2 -> TOPSOIL

3 -> SUBSOIL

4 -> OVERBURDEN

5 -> SURFACE WATER HYDROLOGY

6 -> GROUND WATER HYDROLOGY

7 -> VEGETATION

8 -> ANIMALS

9 -> SOCIO  - ECONOMICS

ENTER EDIT CATEGORY  -> 2
```

Figure 116. Selecting the environmental data category to be edited.

```
                  EDIT RESPONSES/TOPSOIL

    IN WHICH HEADING IS YOUR DESIRED EDIT ?
     (ENTER A,B,C,D,E,F,G,H,I, OR NONE) -> A
III.) TOPSOIL :           ********************************************
                          *           STANDARD EXPECTATIONS          *
                          ********************************************
                          *CROP*  NATIVE  *WILD*  WATER   *HIGH*OTHER*
                          *LAND*VEGETATION*LIFE*RECREATION*USE *     *
**********************************************************************
                          *    *          *    *          *    *     *
 A.) THICKNESS (INCHES) : *    *          *    *          *    *     *
  1.)  0.0-5.9            *  1 *    1     *  1 *    1     *  1 *  0  *
  2.)  6.0-11.9           *  2 *    2     *  2 *    2     *  2 *  0  *
  3.) 12.0-22.9           *  2 *    3     *  3 *    2     *  2 *  0  *
  4.) 24.0- +             *  3 *    3     *  3 *    2     *  2 *  0  *
    WHERE IS YOUR CHANGE ?
    0) NO CHANGE
    1) THICKNESS  (CATEGORY)
    2) ACTUAL THICKNESS  (INCHES)
    3) COST TO REMOVE SOIL FOR STORAGE
    4) COST TO RESPREAD TOPSOIL
    ENTER YOUR CHOICE HERE -> 1
    YOUR CURRENT RESPONSE IS ->2

    ENTER YOUR NEW RESPONSE HERE -> 1
    ANY MORE EDITS TO TOPSOIL ?
     (YES OR NO) -> NO
```

Figure 117. Entering a new answer to the subheading answered before.

```
    IN WHICH HEADING IS YOUR DESIRED EDIT ?
    (ENTER A,B,C, OR NONE) -> A
I.) GENERAL DESCRIPTION:  ****************************************
                          *          STANDARD EXPECTATIONS       *
                          ****************************************
                          *CROP*  NATIVE  *WILD*  WATER   *HIGH*OTHER*
                          *LAND*VEGETATION*LIFE*RECREATION*USE *     *
**********************************************************************
                          *    *          *    *          *    *     *
 A.) TYPE OF MINE :       *    *          *    *          *    *     *
  1.) DRAGLINE            *  1 *     2    *  2 *     2    * 2  *  0  *
  2.) TRUCK AND SHOVEL    *  2 *     2    *  2 *     2    * 2  *  0  *
    IN WHICH SUB-HEADING IS THE EXPECTATION VALUE
    YOU WISH TO CHANGE ? (ENTER THE APPROPRIATE NUMBER) -> 2
```

Figure 118. Selection of heading and subheading for editing the general mine description expectation of success values.

```
    SELECT THE LAND USE OPTION YOU WISH TO CHANGE
  -1-   /  -2-   /  -3-   /  -4-   /  -5-   /  -6- /
CROPLAND/NAT.VEG./WILDLIFE/WAT.REC./HIGH USE/ OTHER/
    ENTER YOUR SELECTION HERE -> 2
    ENTER YOUR NEW EXPECTATION VALUE HERE -> 2
```

Figure 119. Entering the new expectation of success value.

4. Expectation of success values for environmental data are changed through edit option 4 (Fig. 110). The user chooses the appropriate category (Fig. 120), then selects the heading and subheading (Fig. 121). Lastly, the user selects the proper land use, and then makes the desired change to the expectation value (Fig. 122).

5. The last, and maybe the most important, of the edit executive options is the ability to change the current input costs to TECON (Fig. 123). Using this option, a manager may change any of the baseline costs in the CLAIM system so that they will reflect his local market conditions. All costs in this list (Fig. 124) are on a per acre basis, with a January 1979 price base. Before the user changes these values, he should carefully read the TECON section in this manual, so that he understands the assumptions that underly the setting of these costs. For instance, the irrigation and fencing costs are based on 160 and 40 acre field sizes, respectively. The fertilizer costs are based on whether the site currently has a low, medium, or high level of each particular nutrient.

The user may select, and change, any cost item as he pleases (Fig. 124). He then may actually implement the change, or abort it (Fig. 125). Once a change is implemented, it becomes a permanent change in the user's own version of the CLAIM system. The user only may change back to a previous value through the edit option.

D. Current Data Review (CLAIM Executive Option 3)

This option allows the user to make a quick check on the current status of data entered in the CLAIM system, or in a file.

0. Selection of data review option "0" returns the user back to the CLAIM executive.

1. A user may display the current data that have been entered in the CLAIM system by selecting data review option 1 (Fig. 126). The computer will then display the categories, headings, subheadings, and land use options, and will give the expectation of success values for the subheading that was selected (marked with asterisks - Fig. 127). The user also may review spoils grading data and volume calculations from the truck and shovel input option, for each land use (Fig. 128). When done with this option, the user selects the letter "X" to exit.

2. Option 2 of the data review executive allows the user to look at all of the expectation of success values that are entered for all CLAIM subheadings (Fig. 129). By comparing this list with the list

```
*** EDIT MODE ***
-----------------

0 -> EXIT

1 -> CLIMATOLOGY

2 -> TOPSOIL

3 -> SUBSOIL

4 -> OVERBURDEN

5 -> SURFACE WATER HYDROLOGY

6 -> GROUND WATER HYDROLOGY

7 -> VEGETATION

8 -> ANIMALS

9 -> SOCIO  - ECONOMICS

ENTER EDIT CATEGORY  -> 1
```

Figure 120. Choosing the category to edit expectation of success values for environmental data.

```
                    EDIT EXPECTATIONS/CLIMATOLOGY


     IN WHICH HEADING IS YOUR DESIRED EDIT?
      (ENTER A, B,  OR NONE) -> A


II.) CLIMATOLOGY :        ********************************************
                          *          STANDARD EXPECTATIONS           *
                          ********************************************
                          *CROP*  NATIVE  *WILD*  WATER   *HIGH*OTHER*
                          *LAND*VEGETATION*LIFE*RECREATION*USE *     *
**********************************************************************
                          *    *          *    *          *    *     *
A.) AVERAGE TOTAL ANNUAL  *    *          *    *          *    *     *
   PRECIPITATION (IN)     *    *          *    *          *    *     *
  1.)  5.0-10.0           *  1 *     1    *  1 *    1     * 1  *  0  *
  2.) 10.1-15.0           *  1 *     2    *  2 *    1     * 2  *  0  *
  3.) 15.1-20.0           *  2 *     3    *  2 *    2     * 2  *  0  *
  4.) 20.1-25.0           *  3 *     3    *  3 *    3     * 2  *  0  *

     IN WHICH SUB-HEADING IS THE EXPECTATION VALUE
     YOU WISH TO CHANGE ?  (ENTER THE APPROPRIATE NUMBER) -> 2
```

Figure 121. Selecting the heading and subheading to edit expectation of success values for environmental data.

```
II.) CLIMATOLOGY :          *********************************************
                            *            STANDARD EXPECTATIONS          *
                            *********************************************
                            *CROP*  NATIVE   *WILD*  WATER    *HIGH*OTHER*
                            *LAND*VEGETATION*LIFE*RECREATION*USE *     *
**************************************************************************
                            *    *          *    *          *    *     *
A.) AVERAGE TOTAL ANNUAL    *    *          *    *          *    *     *
    PRECIPITATION (IN)      *    *          *    *          *    *     *
  1.)  5.0-10.0             * 1  *    1     * 1  *    1     * 1  *  0  *
  2.) 10.1-15.0             * 1  *    2     * 2  *    1     * 2  *  0  *
  3.) 15.1-20.0             * 2  *    3     * 2  *    2     * 2  *  0  *
  4.) 20.1-25.0             * 3  *    3     * 3  *    3     * 2  *  0  *

    IN WHICH SUB-HEADING IS THE EXPECTATION VALUE
    YOU WISH TO CHANGE ?  (ENTER THE APPROPRIATE NUMBER) -> 2

    SELECT THE LAND USE OPTION YOU WISH TO CHANGE
  -1-   /  -2-   /  -3-   /  -4-   /  -5-   /  -6- /
CROPLAND/NAT.VEG./WILDLIFE/WAT.REC./HIGH USE/ OTHER/
    ENTER YOUR SELECTION HERE -> 2

    ENTER YOUR NEW EXPECTATION VALUE HERE -> 2

    ANY MORE EDITS TO CLIMATOLOGY ?
     (YES OR NO) -> NO
```

Figure 122. Making the expectation value change for an environmental datum.

```
******************************
*                            *
*           CLAIM            *
*                            *
*  COMPUTERIZED RECLAMATION  *
*      PLANNING SYSTEM       *
*                            *
******************************
-----------
 DATA EDIT
-----------

0 -> EXIT FROM DATA EDIT OPTION

1 -> EDIT THE GENERAL MINE DESCRIPTION

2 -> EDIT RESPONSES TO ENVIRONMENTAL DATA

3 -> EDIT EXPECTATION OF SUCCESS VALUES FOR
     THE GENERAL MINE DESCRIPTION

4 -> EDIT EXPECTATION OF SUCCESS VALUES FOR
     ENVIRONMENTAL DATA

5 -> EDIT TECON COSTS

ENTER YOUR SELECTION -> 5
```

Figure 123. Choosing to edit TECON base costs.

```
 1)  COST PER ACRE TO APPLY HAY MULCH                                  :30.000
 2)  COST PER ACRE TO BUY/APPLY HERBICIDE                              : 2.750
 3)  COST PER ACRE TO BUY FERTILIZER : N ("LOW")                       : 9.000
 4)  COST PER ACRE TO BUY FERTILIZER : N ("MED")                       : 4.000
 5)  COST PER ACRE TO BUY FERTILIZER : N ("HIGH")                      : 1.000
 6)  COST PER ACRE TO BUY FERTILIZER : P ("LOW")                       : 7.000
 7)  COST PER ACRE TO BUY FERTILIZER : P ("MED")                       : 2.800
 8)  COST PER ACRE TO BUY FERTILIZER : P ("HIGH")                      :  .750
 9)  COST PER ACRE TO BUY/APPLY HAY MULCH                              :37.500
10)  COST PER ACRE TO BUY SEED (CROPLAND)                              : 4.000
11)  COST PER ACRE TO BUY SEED (NVEG,WLIFE,WREC,HUSE)                  :40.000
12)  COST PER ACRE FOR CHAINING                                        : 5.000
13)  COST PER ACRE TO CHISEL PLOW                                      :10.500
14)  COST PER ACRE TO DRILL FERTILIZER                                 : 1.000
15)  COST PER ACRE TO DISC AND HARROW                                  : 3.750
16)  COST PER ACRE TO DRILL SEED                                       : 3.750
17)  COST PER ACRE TO ERECT ANIMAL FENCING                             :40.000
18)  COST PER ACRE TO HYDROMULCH SEED AND FERTILIZER                   :400.00
19)  COST PER ACRE TO HAND PLANT SHRUB AND TREE SEEDLINGS              :150.00
20)  COST PER ACRE TO IRRIGATE PLANTINGS                               :33.000
21)  COST PER ACRE TO RIP THREE FOOT CENTERS                           :450.00
22)  COST PER ACRE FOR SNOW FENCING                                    :16.500
23)  COST PER ACRE TO SEED NURSE CROP                                  : 6.750
24)  PERCENTAGE FOR STABILIZATION OF TOPSOIL STORAGE PILE              :10.000
25)  PERCENTAGE FOR ADMINISTRATION COSTS                               :15.000

ENTER NUMBER CORRESPONDING TO EDIT ITEM
(ZERO TO QUIT) -> 1

ENTER NEW VALUE -> 45
```

Figure 124. Changing the value of a TECON cost item.

```
 1)  COST PER ACRE TO APPLY HAY MULCH                              :45.000
 2)  COST PER ACRE TO BUY/APPLY HERBICIDE                          : 2.750
 3)  COST PER ACRE TO BUY FERTILIZER : N ("LOW")                   : 9.000
 4)  COST PER ACRE TO BUY FERTILIZER : N ("MED")                   : 4.000
 5)  COST PER ACRE TO BUY FERTILIZER : N ("HIGH")                  : 1.000
 6)  COST PER ACRE TO BUY FERTILIZER : P ("LOW")                   : 7.000
 7)  COST PER ACRE TO BUY FERTILIZER : P ("MED")                   : 2.800
 8)  COST PER ACRE TO BUY FERTILIZER : P ("HIGH")                  :  .750
 9)  COST PER ACRE TO BUY/APPLY HAY MULCH                          :37.500
10)  COST PER ACRE TO BUY SEED (CROPLAND)                          : 4.000
11)  COST PER ACRE TO BUY SEED (NVEG,WLIFE,WREC,HUSE)              :40.000
12)  COST PER ACRE FOR CHAINING                                    : 5.000
13)  COST PER ACRE TO CHISEL PLOW                                  :10.500
14)  COST PER ACRE TO DRILL FERTILIZER                             : 1.000
15)  COST PER ACRE TO DISC AND HARROW                              : 3.750
16)  COST PER ACRE TO DRILL SEED                                   : 3.750
17)  COST PER ACRE TO ERECT ANIMAL FENCING                         :40.000
18)  COST PER ACRE TO HYDROMULCH SEED AND FERTILIZER               :400.00
19)  COST PER ACRE TO HAND PLANT SHRUB AND TREE SEEDLINGS          :150.00
20)  COST PER ACRE TO IRRIGATE PLANTINGS                           :33.000
21)  COST PER ACRE TO RIP THREE FOOT CENTERS                       :450.00
22)  COST PER ACRE FOR SNOW FENCING                                :16.500
23)  COST PER ACRE TO SEED NURSE CROP                              : 6.750
24)  PERCENTAGE FOR STABILIZATION OF TOPSOIL STORAGE PILE          :10.000
25)  PERCENTAGE FOR ADMINISTRATION COSTS                           :15.000

ENTER NUMBER CORRESPONDING TO EDIT ITEM
(ZERO TO QUIT) -> 0

IMPLEMENT CHANGES OR ABORT ? (IM OR AB) -> AB
```

Figure 125. Option to make an edited TECON value a permanent change to the CLAIM system.

```
******************************
*                            *
*           CLAIM            *
*                            *
*  COMPUTERIZED RECLAMATION  *
*      PLANNING SYSTEM       *
*                            *
******************************
----------------------
 CURRENT DATA REVIEW
----------------------

0 -> EXIT FROM DATA REVIEW OPTION

1 -> DISPLAY CURRENT CLAIM DATA SET

2 -> DISPLAY CURRENT EXPECTATION OF SUCCESS VALUES


ENTER YOUR SELECTION -> 1
DISPLAY ON TERMINAL OR LINE PRINTER ?(TT OR LP) ->TT
```

Figure 126. Selection of data review option 1.

```
1  NTYPICAL NORTHERN GREAT PLAINS NATIVE VEGETATION

*** LIST OF RESPONSES TO ENVIRONMENTAL FEASIBILITY CATEGORIES ***

         RESPONSE                 EXPECTATION OF SUCCESS VALUES
       -------------              ----------- ----------------
                               /CROP/NAT./WILD/WAT./HIGH/OTHER/
                               /LAND/VEG./LIFE/REC./USE /     /
=====================================================================


   I.) GENERAL DESCRIPTION:
    A.) TYPE OF MINE :
**   1.) DRAGLINE                 2    2    2    2    2    0

    B.) STAGE IN MINING
        SEQUENCE :
**   2.) MINE RUN                 2    2    2    2    2    0

    C.) AVERAGE SLOPE OF
        10 RANDOM POINTS
        IN THE AREA :
**   2.)  3.01 - 5.70             2    3    2    3    2    0


   AVERAGE COST TO EXCAVATE SPOIL :        20.00 CENTS PER CUBIC YARD

=====================================================================

ENTER C TO CONTINUE, X TO EXIT -> C
```

Figure 127. Review of subheading selections with their corresponding expectation of success values.

```
1          *** TRUCK & SHOVEL MINE : CROPLAND***

 NO.    HIGHWALL SLOPE  HIGHWALL HEIGHT  BENCH WIDTH  BENCH LENGTH
 * 1   *     34.00     *     35.00     *    323.52    *   1000.00

 * 2   *     34.00     *     35.00     *    200.00    *   1000.00

-------------------------------------------------------------------
  ** COST OF GRADING OVERBURDEN    :     20.00 CENTS/CUBIC YARD
  ** AREA COVERED BY UNGRADED SPOILS :     17.83 ACRES
  ** REHANDLE VOLUME               :  10000.00 CUBIC YARDS
  ** REHANDLE COST                 :     56.00 CENTS/CUBIC YARD
-------------------------------------------------------------------

 NO.    FINAL HIGHWALL SLOPE  FINAL TERRACE WIDTH

 * 1      *      5.70      *       .00
 * 2      *      5.00      *     25.89
 ENTER C TO CONTINUE, X TO EXIT ->
```

Figure 128. Review of grading data input for a truck and shovel mine - cropland option.

```
                   ******************************
                   *                            *
                   *            CLAIM           *
                   *                            *
                   *  COMPUTERIZED RECLAMATION  *
                   *      PLANNING SYSTEM       *
                   *                            *
                   ******************************
----------------------
 CURRENT DATA REVIEW
----------------------

0 -> EXIT FROM DATA REVIEW OPTION

1 -> DISPLAY CURRENT CLAIM DATA SET

2 -> DISPLAY CURRENT EXPECTATION OF SUCCESS VALUES


ENTER YOUR SELECTION -> 2
```

Figure 129. Selecting the display of current expectation of success values.

in the CLAIM databook, the user may determine if any forgotten edits were made to the expectation values. Since this list is quite long, and takes some time to analyze, it is automatically dumped to the line printer, to form a permanent record (Fig. 130).

E. Data Storage (CLAIM Executive Option 4)

The data storage option of the CLAIM executive allows a user to permanently store data that were entered manually. If they are not stored in this way, they will be lost when the next data set is entered, or when the system is turned off.

0. Entering of a "0" in the data storage executive (Fig. 131) returns the user to the CLAIM executive.

1, 2, 3, 4. Three broad types of data are manually input into the CLAIM system (see Fig. 108). These are: general mine description data, environmental data, and expectation of success values. All three types may be stored in permanent files in the four data storage options (Fig. 131). (Option 3 allows the storage of two kinds of data in one file.) Since the storage method is the same for all four files, they will all be discussed together. Remember, however, that no two files of the same data type can have the same code name, but the same name can be used in different file types (such as a general mine description file and an environmental data file).

A new data file is created first by manually inputting the data in the CLAIM input mode, such as current mine description data. The storage option corresponding to the desired data type (Fig. 131) is then selected, and the computer responds by requesting a 1-4 letter file code name (Fig. 132). The user makes up whatever code name he wants, then inputs a desired title. He then hits the return button on the CRT, and the file is permanently stored.

If the user inputs a file code name that already was stored, the computer advises him of this fact (Fig. 133). If this was an accident, the user will probably not write over the existing file but, if he does still wish to store this new data set, he will input a new file title. To do this, the computer cycles back to the new data file storage routine (Fig. 134).

In some cases, the user may have decided to change some of the data in an existing file. After doing this (in the edit mode) he then may enter the same file code name and, again, he will be told the file already exists (Fig. 135). If he wishes to dispose of the original file,

LIST OF EXPECTATIONS OF SUCCESS VALUES

SECTION	CATAGORY	SELECTION	CROP	NATIVE	WILDLIFE	WATER PEL	HIGH USE	OTHER
1	A	1	2	2	2	3	2	0
1	A	2	2	2	2	2	2	0
1	B	1	1	1	2	1	1	0
1	B	2	2	2	2	2	2	0
1	B	3	1	1	3	3	1	0
1	C	1	3	2	2	2	3	0
1	C	2	2	3	2	3	2	0
1	C	3	0	2	3	2	1	0
2	A	1	1	1	1	1	1	0
2	A	2	1	2	2	1	2	0
2	A	3	2	3	2	2	2	0
2	A	4	3	3	3	3	2	0
2	B	1	3	3	3	3	3	0
2	B	2	2	2	2	2	2	0
2	B	3	1	1	2	2	2	0
2	B	4	1	1	1	1	1	0
3	A	1	1	1	1	1	1	0
3	A	2	2	2	2	2	2	0
3	A	3	2	3	3	2	2	0
3	A	4	3	3	3	2	2	0
3	B	1	1	1	1	1	2	0
3	B	2	2	2	2	2	2	0
3	B	3	3	3	3	3	2	0
3	C	1	1	1	1	1	1	0

```
******************************
*                            *
*            CLAIM           *
*                            *
*  COMPUTERIZED RECLAMATION  *
*      PLANNING SYSTEM       *
*                            *
******************************
--------------
 DATA STORAGE
--------------

0 -> EXIT FROM THE DATA STORAGE OPTION

1 -> STORE THE CURRENT GENERAL DESCRIPTION

2 -> STORE THE ENVIRONMENTAL  DATA

3 -> STORE BOTH THE GENERAL MINE DESCRIPTION AND
     THE ENVIRONMENTAL DATA

4 -> STORE THE CURRENT EXPECTATION OF SUCCESS VALUES


ENTER YOUR SELECTION -> 1
```

Figure 131. Data storage executive for creating CLAIM data files.

```
DATA STORAGE
GENERAL DESCRIPTION AND ENVIRONMENTAL DATA
------------------------------------------


INPUT THE FILE NAME -> TEST
INPUT TITLE -> TYPICAL NORTHERN GREAT PLAINS MINE SITE.
```

Figure 132. Entering a 1-4 letter code name and a title for a new data storage file.

```
DATA STORAGE
ENVIRONMENTAL DATA
------------------


INPUT THE FILE NAME -> NVGO
THE FILE :NVGO ALREADY EXISTS.
TITLE ->NVGO FILE ENVIRONMENTAL  DATA RESPONSES.


DO YOU WANT TO WRITE OVER THIS FILE ? NO
DO YOU WANT TO INPUT A NEW FILE NAME ? NO
```

Figure 133. Input of a pre-existing file name, with a message that it already exists.

```
DATA STORAGE
ENVIRONMENTAL DATA
------------------


INPUT THE FILE NAME -> 0
THE FILE :0    ALREADY EXISTS.
TITLE ->0


DO YOU WANT TO WRITE OVER THIS FILE ? YES
INPUT TITLE -> TEST FILE
```

Figure 134. Giving a new title to a new file under the same code name.

```
DATA STORAGE
ENVIRONMENTAL DATA
------------------

INPUT THE FILE NAME -> NVGO
THE FILE :NVGO ALREADY EXISTS.
TITLE ->NVGO FILE ENVIRONMENTAL DATA RESPONSES

DO YOU WANT TO WRITE OVER THIS FILE ? YES
INPUT TITLE -> NVGO FILE ENVIRONMENTAL  DATA RESPONSES.
```

Figure 135. Inputting a new data set under a pre-existing file code name and title.

and replace it with the new file, he can do so by saying "yes", that he wants to write over the original file. He then may input a new title (or retype the same one as before), and the code name will stay the same. In this way, a file can be continuously updated as conditions change. This is the basic method of getting rid of an outdated data file.

If the user desires to get rid of a file code name, as well as the data, this is slightly more complicated. To do this, the file code must be purged from the computer's disc storage device. For the Hewlett-Packard hardware described previously, this is done with the following commands (after exiting from the CLAIM system):

Table 3. File code name purging methods.

: PU, $ * __ __ __ __	(general mine description data file)
: PU, # * __ __ __ __	(environmental data file)
: PU, * * __ __ __ __	(general mine and environmental data file)
: PU, # $ __ __ __ __	(expectation of success value file)

The four dashes in the above commands would be replaced by the 1-4 letter code name of the file the user wishes to purge. (The colon symbol is the system prompt.) Remember, when these purge commands are used, the whole data file, and its code name, are permanently lost from CLAIM.

F. Data Analysis (CLAIM Executive Option 5)

The data analysis portion of CLAIM is what processes all of the input data, and generates an end result. This section here will be devoted only to showing the results of various analyses, with some common warning messages that correspond to certain data inputs. The methods of calculating these values is discussed under the sections on FEASI, TECON, OPUSE, and GRADE logic.

0. A "0" response in the data analysis executive (Fig. 138) returns the user to the CLAIM executive. Selecting any of the other 3 responses will, first, elicit a reminder that grading parameters have been entered for the land uses that are appropriate to the current stage in the mining sequence (such as mine run, or opening cut - Fig. 136). If the data base is not complete, a message such as that in

```
GENERAL DESCRIPTION STATUS :

GRADING PARAMETERS HAVE BEEN ENTERED FOR :

* CROPLAND ALTERNATIVE
* NAT.VEG. ALTERNATIVE
* WILDLIFE ALTERNATIVE
* WAT.REC. ALTERNATIVE
* HIGH USE ALTERNATIVE
HIT THE RETURN KEY TO CONTINUE....
```

Figure 136. Reminder that grading parameters have been entered from the data base, which will be used in calculating TECON costs.

Fig. 137 will be displayed, and no data analysis will be feasible.

1. Selecting the "1" response in the data analysis executive allows the user to obtain the FEASI ranking. This is the relative environmental feasibility of returning to each of the 5 major land use options (or 6 with the "other" option). Figure 139 shows a typical FEASI list for a rangeland site in the Northern Great Plains, with no "other" land use entered.

2. The second data analysis option provides a TECON list of the reclamation techniques and costs for reclaiming a site back to each of the 5 land uses. All costs and techniques are specifically developed for the user's current data set, using methods listed in the TECON logic section, discussed later. Figures 140-144 show 5 TECON lists for the same typical Northern Great Plains rangeland data set as used in the above FEASI analysis.

TECON is set so that the least expensive land use is shown first, then progressing on up to the last, most expensive land use (for that particular site). A grand total cost for the total acreage covered by the spoils is also calculated by TECON.

The user should note that TECON costs per acre are calculated based on the percentage of the reclaimed area to which a particular technique is applied which, in turn, is based on the final topography. For example, hydromulching costs about $400.00 per acre, and is used on slopes of 19 degrees or more (see TECON logic section). The current default slope mix for wildlife has 25 percent of the area covered by 19 degree slopes. Therefore, the average hydromulching cost is $100.00 per acre for the whole area (see Fig. 140). All TECON costs are averaged in this way. For an actual total cost of a technique, when applied to an entire acre, the user should consult the TECON cost table (Fig. 124).

3. User selection of the third data analysis option produces the optimum land use (OPUSE) table (Fig. 145). This output repeats the FEASI rankings, summarizes the per acre reclamation costs for each land use, and combines the two into a single list of most to least optimal use. (This is produces by finding the product of a land use's feasibility and the reciprocal of its cost per acre, times 1000.) This method of calculation places equal weight on the relative importance of maximizing the reclamation feasibility, and minimizing its cost.

4. Special data analysis messages. In some cases, a site may have certain mining characteristics or environmental restrictions that prevent establishing a particular land use. Likewise, laws or physical

```
GENERAL DESCRIPTION STATUS :

GRADING PARAMETERS HAVE BEEN ENTERED FOR :

* NAT.VEG. ALTERNATIVE

* WILDLIFE ALTERNATIVE

* WAT.REC. ALTERNATIVE

ENVIRONMENTAL FEASIBILITY CATEGORIES HAVE
NOT BEEN ENTERED STARTING CATEGORY  2, HEADING  A

DO YOU WISH TO COMPLETE DATA ENTRIES ? NO
HIT THE RETURN KEY TO CONTINUE....
```

Figure 137. Message appearing when trying to run a data analysis with an incomplete environmental data set (final cut dragline mine).

```
                ******************************
                *                            *
                *            CLAIM           *
                *                            *
                *  COMPUTERIZED RECLAMATION  *
                *      PLANNING SYSTEM       *
                *                            *
                ******************************
---------------
 DATA ANALYSIS
---------------

0 -> EXIT FROM DATA ANALYSIS OPTION

1 -> ENVIRONMENTAL FEASIBILITY RANKINGS

2 -> TECHNIQUES AND ECONOMICS ANALYSIS

3 -> OPTIMUM USE FACTORS


ENTER YOUR SELECTION -> 1
DISPLAY ON TERMINAL OR LINE PRINTER ?(TT OR LP) ->TT
```

Figure 138. Selecting the FEASI analysis from the data analysis executive.

```
1   TYPICAL NORTHERN GREAT PLAINS NATIVE VEGETATION

            FEASIBILITY INDEXES FOR THE CURRENT DATA
            ----------------------------------------

              1) NAT.VEG.                      2.184
              2) WILDLIFE                      2.097
              3) WAT.REC.                      2.061
              4) HIGH USE                      1.997
              5) CROPLAND                      1.899
              6) OTHER                          .000

================================================================

HIT THE RETURN KEY TO CONTINUE :
```

Figure 139. Typical environmental feasibility (FEASI) list for a Northern Great Plains rangeland site.

TYPICAL NORTHERN GREAT PLAINS NATIVE VEGETATION

*** WILDLIFE ALTERNATIVE ***

TECHNIQUE	COST/ACRE
1)STRIP ALL TOPSOIL	$ 665.50
2)RESPREAD ALL TOPSOIL	$ 499.12
3)STRIP 1 FOOT OF SUBSOIL	$ 726.00
4)RESPREAD 1 FOOT OF SUBSOIL	$ 544.50
5)GRADE SPOIL	$ 986.59
6)CHISEL PLOW	$ 7.87
7)DISC AND HARROW	$ 2.81
8)CHAINING	$ 1.25
9)BUY SEED	$ 50.00
10)DRILL SEED	$ 2.81
11)BUY FERTILIZER : NITROGEN	$ 9.00
12)BUY FERTILIZER : PHOSPHATE	$ 7.00
13)DRILL FERTILIZER	$ .75
14)BUY HAY MULCH	$ 28.12
15)APPLY HAY MULCH	$ 22.50
16)HYDROMULCH SEED AND FERTILIZER	$ 100.00
17)HAND PLANT SHRUB AND TREE SEEDLINGS	$ 150.00
18)ERECT ANIMAL FENCING	$ 40.00
19)STABILIZE TOPSOIL STORAGE PILE	$ 13.09
20)ADMIN. OF OPERATIONS AND NECESSARY TESTS	$ 578.54
	=========
TOTAL	$ 4435.46

GRAND TOTAL COST FOR 300.0 ACRES IS 1.33 MILLION DOLLARS

Figure 140. TECON list for the wildlife land use (least expensive).

TYPICAL NORTHERN GREAT PLAINS NATIVE VEGETATION

*** NATIVE VEGETATION ALTERNATIVE ***

TECHNIQUE	COST/ACRE
1)STRIP ALL TOPSOIL	$ 665.50
2)RESPREAD ALL TOPSOIL	$ 499.12
3)STRIP 1 FOOT OF SUBSOIL	$ 726.00
4)RESPREAD 1 FOOT OF SUBSOIL	$ 544.50
5)GRADE SPOIL	$ 1030.84
6)CHISEL PLOW	$ 7.87
7)DISC AND HARROW	$ 2.81
8)CHAINING	$ 1.25
9)BUY SEED	$ 50.00
10)DRILL SEED	$ 2.81
11)BUY FERTILIZER : NITROGEN	$ 9.00
12)BUY FERTILIZER : PHOSPHATE	$ 7.00
13)DRILL FERTILIZER	$ .75
14)BUY HAY MULCH	$ 28.12
15)APPLY HAY MULCH	$ 22.50
16)HYDROMULCH SEED AND FERTILIZER	$ 100.00
17)HAND PLANT SHRUB AND TREE SEEDLINGS	$ 150.00
18)ERECT ANIMAL FENCING	$ 40.00
19)STABILIZE TOPSOIL STORAGE PILE	$ 13.09
20)ADMIN. OF OPERATIONS AND NECESSARY TESTS	$ 585.18
	=========
TOTAL	$ 4486.35

GRAND TOTAL COST FOR 300.0 ACRES IS 1.35 MILLION DOLLARS

Figure 141. TECON list for native vegetation reclamation.

TYPICAL NORTHERN GREAT PLAINS NATIVE VEGETATION

*** WATER RECREATION ALTERNATIVE ***

TECHNIQUE	COST/ACRE
1)STRIP ALL TOPSOIL	$ 798.60
2)RESPREAD ALL TOPSOIL	$ 598.95
3)STRIP 1 FOOT OF SUBSOIL	$ 871.20
4)RESPREAD 1 FOOT OF SUBSOIL	$ 653.40
5)GRADE SPOIL	$ 1074.64
6)CHISEL PLOW	$ 9.45
7)DISC AND HARROW	$ 3.37
8)CHAINING	$ .50
9)BUY SEED	$ 44.00
10)DRILL SEED	$ 3.37
11)BUY FERTILIZER : NITROGEN	$ 9.00
12)BUY FERTILIZER : PHOSPHATE	$ 7.00
13)DRILL FERTILIZER	$ .90
14)BUY HAY MULCH	$ 33.75
15)APPLY HAY MULCH	$ 27.00
16)HYDROMULCH SEED AND FERTILIZER	$ 40.00
17)HAND PLANT SHRUB AND TREE SEEDLINGS	$ 150.00
18)BUY,APPLY HERBICIDE	$ 2.75
19)ERECT ANIMAL FENCING	$ 40.00
20)STABILIZE TOPSOIL STORAGE PILE	$ 14.06
21)ADMIN. OF OPERATIONS AND NECESSARY TESTS	$ 657.29
	=========
TOTAL	$ 5039.25

GRAND TOTAL COST FOR 300.0 ACRES IS 1.51 MILLION DOLLARS

Figure 142. TECON list for water-based recreation reclamation.

TYPICAL NORTHERN GREAT PLAINS NATIVE VEGETATION

*** CROPLAND ALTERNATIVE ***

TECHNIQUE	COST/ACRE
1)STRIP ALL TOPSOIL	$ 887.33
2)RESPREAD ALL TOPSOIL	$ 665.50
3)STRIP 1 FOOT OF SUBSOIL	$ 968.00
4)RESPREAD 1 FOOT OF SUBSOIL	$ 726.00
5)GRADE SPOIL	$ 1231.31
6)CHISEL PLOW	$ 10.50
7)DISC AND HARROW	$ 3.75
8)BUY SEED	$ 4.00
9)DRILL SEED	$ 3.75
10)BUY FERTILIZER : NITROGEN	$ 9.00
11)BUY FERTILIZER : PHOSPHATE	$ 7.00
12)DRILL FERTILIZER	$ 1.00
13)BUY HAY MULCH	$ 37.50
14)APPLY HAY MULCH	$ 30.00
15)BUY,APPLY HERBICIDE	$ 2.75
16)ERECT ANIMAL FENCING	$ 40.00
17)STABILIZE TOPSOIL STORAGE PILE	$ 10.92
18)ADMIN. OF OPERATIONS AND NECESSARY TESTS	$ 695.75
	=========
TOTAL	$ 5334.07

GRAND TOTAL COST FOR 300.0 ACRES IS 1.60 MILLION DOLLARS

Figure 143. TECON list for cropland reclamation.

TYPICAL NORTHERN GREAT PLAINS NATIVE VEGETATION

*** HIGH USE ALTERNATIVE ***

TECHNIQUE	COST/ACRE
1)STRIP ALL TOPSOIL	$ 887.33
2)RESPREAD ALL TOPSOIL	$ 665.50
3)STRIP 1 FOOT OF SUBSOIL	$ 968.00
4)RESPREAD 1 FOOT OF SUBSOIL	$ 726.00
5)GRADE SPOIL	$ 1177.60
6)CHISEL PLOW	$ 10.50
7)DISC AND HARROW	$ 3.75
8)BUY SEED	$ 40.00
9)DRILL SEED	$ 3.75
10)BUY FERTILIZER : NITROGEN	$ 9.00
11)BUY FERTILIZER : PHOSPHATE	$ 7.00
12)DRILL FERTILIZER	$ 1.00
13)BUY HAY MULCH	$ 37.50
14)APPLY HAY MULCH	$ 30.00
15)HAND PLANT SHRUB AND TREE SEEDLINGS	$ 150.00
16)BUY,APPLY HERBICIDE	$ 2.75
17)ERECT ANIMAL FENCING	$ 40.00
18)STABILIZE TOPSOIL STORAGE PILE	$ 14.52
19)ADMIN. OF OPERATIONS AND NECESSARY TESTS	$ 716.13
	=========
TOTAL	$ 5490.34

GRAND TOTAL COST FOR 300.0 ACRES IS 1.65 MILLION DOLLARS

Figure 144. TECON list for the high human use reclamation option (most expensive).

1 TYPICAL NORTHERN GREAT PLAINS NATIVE VEGETATION

*** COMPARISONS AND OPTIMUM USE FACTORS ***

FEASIBILITY RANKING		COST PER ACRE		OPTIMUM USE	
1). NAT.VEG.	2.184	1). WILDLIFE	4435.46	1). NAT.VEG.	.48688
2). WILDLIFE	2.097	2). NAT.VEG.	4486.35	2). WILDLIFE	.47284
3). WAT.REC.	2.061	3). WAT.REC.	5039.25	3). WAT.REC.	.40902
4). HIGH USE	1.997	4). CROPLAND	5334.07	4). HIGH USE	.36370
5). CROPLAND	1.899	5). HIGH USE	5490.34	5). CROPLAND	.35598

HIT THE RETURN KEY TO CONTINUE :

Figure 145. The OPUSE summary table for a typical Northern Great Plains rangeland site.

characteristics may dictate that a land use must be reestablished. When this happens, the FEASI list will "flag" the land use of concern, and present a message about why it should, or should not, be a part of the reclamation plan. In such instances, FEASI will produce the complete feasibility ranking list for user review. In TECON, however, a list of techniques and costs will be produced only for those land uses that are not prohibited by some law or environmental factor. A message will be presented for each land use saying whether or not it may be reestablished. Likewise, the OPUSE table will print only those land uses which are allowable.

The following examples provide some samples of these conditions and messages:

(a) Presence of "prime agricultural land" (as defined by federal law). When this occurs, FEASI indicates that cropland is the only possible post-mining land use (Fig. 146). TECON states that native vegetation and wildlife management options are not available, except as a secondary use (such as in fence rows and corners - see Fig. 147). TECON then states that water-based recreation and high human use are not compatible with prime agricultural land (see Fig. 148 for high use).

The only TECON list presented is that for cropland (Fig. 149), with a message saying that this use is required. Similarly, the OPUSE routine produces a summary only for cropland (Fig. 150).

(b) Average slope of the overall mining area greater than 5.7 degrees. When an area has relatively steep original topography it is very difficult to grade large areas to slopes flat enough for cropland. Consequently, FEASI presents a message prohibiting cropland (Fig. 151). The TECON system produces a similar message for cropland (Fig. 152) and then provides lists for the other 4 land uses. The OPUSE routine summarizes for the same 4 land uses.

(c) If a site has an endangered animal (or plant) species present, FEASI will present a message saying the site must be reclaimed to wildlife, or native vegetation (see Fig. 153 for a wildlife example). The TECON messages indicate that cropland, native vegetation (or wildlife for endangered plants), and water recreation are only possible as secondary land uses (Fig. 154) - which would be used in support of the endangered species' habitat needs. The high use option is prohibited (Fig. 155), and the wildlife land use is the only list produced by TECON (Fig. 156), or by OPUSE.

(d) When a small, minable alluvial valley floor is present on the mine site, FEASI (Fig. 157) produces a message for the high human use option, which says that specific action must be taken to achieve that

```
1   TYPICAL NORTHERN GREAT PLAINS NATIVE VEGETATION

              FEASIBILITY INDEXES FOR THE CURRENT DATA
              ----------------------------------------

                1) NAT.VEG.                  2.125
                2) WILDLIFE                  2.078
                3) WAT.REC.                  2.002
                4) HIGH USE                  1.997
                5) CROPLAND                  1.958 **
                6) OTHER                      .000


======================================================================

  ** YOUR RESPONSE TO :
    X.) SOCIO-ECONOMICS
    B.) PRIMARY PRESENT LAND USE
     WAS ---> 1.) PRIME AGRICULTURAL LAND.

    PRESENT LAWS INDICATE THAT YOU MUST RECLAIM THE LAND TO THIS OPTION
    REGARDLESS OF THE FEASIBILITY RANKING.


HIT THE RETURN KEY TO CONTINUE :
```

Figure 146. FEASI flagging of prime agricultural land, with message.

```
TYPICAL NORTHERN GREAT PLAINS NATIVE VEGETATION

    *** NATIVE VEGETATION ALTERNATIVE ***

REGARDLESS OF OTHER ENVIRONMENTAL CONSIDERATIONS
REFLECTED IN THE FEASIBILITY RANKING,  THE TECHNIQUES
LIST IS NOT AVAILABLE FOR THIS ALTERNATIVE BECAUSE :

  ** THIS LAND USE OPTION MAY BE COMPATABLE WITH
     PRIME AGRICULTURAL LAND,  BUT AS A SECONDARY USE ONLY
```

Figure 147. TECON message prohibiting native vegetation, except as a secondary use (prime agricultural land).

```
TYPICAL NORTHERN GREAT PLAINS NATIVE VEGETATION

      *** HIGH USE ALTERNATIVE ***

REGARDLESS OF OTHER ENVIRONMENTAL CONSIDERATIONS
REFLECTED IN THE FEASIBILITY RANKING,  THE TECHNIQUES
LIST IS NOT AVAILABLE FOR THIS ALTERNATIVE BECAUSE :

    ** THIS LAND USE OPTION IS NOT COMPATABLE WITH
       PRIME AGRICULTURAL LAND
```

Figure 148. TECON message prohibiting high human use reclamation (prime agricultural land).

TYPICAL NORTHERN GREAT PLAINS NATIVE VEGETATION

*** CROPLAND ALTERNATIVE ***

TECHNIQUE	COST/ACRE
1)STRIP ALL TOPSOIL	$ 887.33
2)RESPREAD ALL TOPSOIL	$ 665.50
3)STRIP 1 FOOT OF SUBSOIL	$ 968.00
4)RESPREAD 1 FOOT OF SUBSOIL	$ 726.00
5)GRADE SPOIL	$ 1231.31
6)CHISEL PLOW	$ 10.50
7)DISC AND HARROW	$ 3.75
8)BUY SEED	$ 4.00
9)DRILL SEED	$ 3.75
10)BUY FERTILIZER : NITROGEN	$ 9.00
11)BUY FERTILIZER : PHOSPHATE	$ 7.00
12)DRILL FERTILIZER	$ 1.00
13)BUY HAY MULCH	$ 37.50
14)APPLY HAY MULCH	$ 30.00
15)BUY,APPLY HERBICIDE	$ 2.75
16)ERECT ANIMAL FENCING	$ 40.00
17)STABILIZE TOPSOIL STORAGE PILE	$ 10.92
18)ADMIN. OF OPERATIONS AND NECESSARY TESTS	$ 695.75
	==========
TOTAL	$ 5334.07

GRAND TOTAL COST FOR 300.0 ACRES IS 1.60 MILLION DOLLARS

** PRESENT LAWS INDICATE THAT YOU MUST RECLAIM
TO THIS LAND USE OPTION

Figure 149. TECON list for required cropland use (prime agricultural land).

```
1   TYPICAL NORTHERN GREAT PLAINS NATIVE VEGETATION

          *** COMPARISONS AND OPTIMUM USE FACTORS ***

    FEASIBILITY RANKING         COST PER ACRE          OPTIMUM USE
    -------------------         -------------          -----------

 1). CROPLAND     1.958   1). CROPLAND   5334.07    1). CROPLAND    .36701
    HIT THE RETURN KEY TO CONTINUE :
```

Figure 150. OPUSE list for cropland only (prime agricultural land).

```
1   TYPICAL NORTHERN GREAT PLAINS NATIVE VEGETATION

          FEASIBILITY INDEXES FOR THE CURRENT DATA
          ----------------------------------------

           1) NAT.VEG.                2.165
           2) WILDLIFE                2.117
           3) WAT.REC.                2.042
           4) HIGH USE                1.977
           5) CROPLAND                1.860 **
           6) OTHER                    .000


 ***********************************************************************

  ** YOUR RESPONSE TO :
    I.) GENERAL DESCRIPTION
    C.) AVERAGE SLOPE OF 10 RANDOM POINTS IN THE AREA
     WAS---> 3.) 5.71 - 11.50 DEGREES.

    THIS GENERAL SLOPE EXCEEDS THE MAXIMUM REQUIRED BY THIS
    MODEL FOR THE CROPLAND RECLAMATION ALTERNATIVE.


HIT THE RETURN KEY TO CONTINUE :
```

Figure 151. FEASI message prohibiting cropland on steep general topography.

```
TYPICAL NORTHERN GREAT PLAINS NATIVE VEGETATION

      *** CROPLAND ALTERNATIVE ***

REGARDLESS OF OTHER ENVIRONMENTAL CONSIDERATIONS
REFLECTED IN THE FEASIBILITY RANKING,  THE TECHNIQUES
LIST IS NOT AVAILABLE FOR THIS ALTERNATIVE BECAUSE :

    ** THE AVERAGE SLOPE OF THE AREA EXCEEDS THE
       MAXIMUM  (5.7 DEG/8 PERCENT) REQUIRED TO
       FEASIBLY RECLAIM TO THIS ALTERNATIVE.
```

Figure 152. TECON message prohibiting cropland on steep topography sites.

```
1   TYPICAL NORTHERN GREAT PLAINS NATIVE VEGETATION

                FEASIBILITY INDEXES FOR THE CURRENT DATA
                ----------------------------------------

                 1) NAT.VEG.                   2.125
                 2) WILDLIFE                   2.117 **
                 3) WAT.REC.                   2.022
                 4) HIGH USE                   1.997
                 5) CROPLAND                   1.918
                 6) OTHER                       .000


  **********************************************************************

   ** YOUR RESPONSE TO :
     IX) ANIMALS
      A) CURRENT ABUNDANT WILDLIFE TYPES PRESENT
       WAS --> 5.) PRESENCE OF THREATENED OR ENDANGERED SPECIES

     PRESENT LAWS INDICATE THAT YOU MUST RECLAIM THE LAND TO THIS OPTION
     REGARDLESS OF THE FEASIBILITY RANKING.


HIT THE RETURN KEY TO CONTINUE :
```

Figure 153. FEASI message for an endangered animal species.

```
TYPICAL NORTHERN GREAT PLAINS NATIVE VEGETATION

    *** WATER RECREATION ALTERNATIVE ***

REGARDLESS OF OTHER ENVIRONMENTAL CONSIDERATIONS
REFLECTED IN THE FEASIBILITY RANKING,  THE TECHNIQUES
LIST IS NOT AVAILABLE FOR THIS ALTERNATIVE BECAUSE :

  ** THIS LAND USE OPTION MAY BE COMPATABLE WITH
     THE PRESENCE OF THREATENED OR ENDANGERED
     ANIMAL SPECIES,  BUT AS A SECONDARY USE ONLY
```

Figure 154. TECON message for water recreation as a secondary land use (endangered animal, or plant, species).

```
TYPICAL NORTHERN GREAT PLAINS NATIVE VEGETATION

      *** HIGH USE ALTERNATIVE ***

REGARDLESS OF OTHER ENVIRONMENTAL CONSIDERATIONS
REFLECTED IN THE FEASIBILITY RANKING,  THE TECHNIQUES
LIST IS NOT AVAILABLE FOR THIS ALTERNATIVE BECAUSE :

    ** THIS LAND USE OPTION IS NOT COMPATABLE WITH
       THE PRESENCE OF THREATENED OR ENDANGERED
       ANIMAL SPECIES.
```

Figure 155. TECON message prohibiting the high use option (endangered species present).

TYPICAL NORTHERN GREAT PLAINS NATIVE VEGETATION

*** WILDLIFE ALTERNATIVE ***

TECHNIQUE	COST/ACRE
1)STRIP ALL TOPSOIL	$ 665.50
2)RESPREAD ALL TOPSOIL	$ 499.12
3)STRIP 1 FOOT OF SUBSOIL	$ 726.00
4)RESPREAD 1 FOOT OF SUBSOIL	$ 544.50
5)GRADE SPOIL	$ 986.59
6)CHISEL PLOW	$ 7.87
7)DISC AND HARROW	$ 2.81
8)CHAINING	$ 1.25
9)BUY SEED	$ 50.00
10)DRILL SEED	$ 2.81
11)BUY FERTILIZER : NITROGEN	$ 9.00
12)BUY FERTILIZER : PHOSPHATE	$ 7.00
13)DRILL FERTILIZER	$ .75
14)BUY HAY MULCH	$ 28.12
15)APPLY HAY MULCH	$ 22.50
16)HYDROMULCH SEED AND FERTILIZER	$ 100.00
17)HAND PLANT SHRUB AND TREE SEEDLINGS	$ 150.00
18)STABILIZE TOPSOIL STORAGE PILE	$ 13.09
19)ADMIN. OF OPERATIONS AND NECESSARY TESTS	$ 572.54
	=========
TOTAL	$ 4389.46

GRAND TOTAL COST FOR 300.0 ACRES IS 1.32 MILLION DOLLARS

** PRESENT LAWS INDICATE THAT YOU MUST RECLAIM
TO THIS LAND USE OPTION

Figure 156. TECON list for wildlife management - endangered animal species present.

```
1   TYPICAL NORTHERN GREAT PLAINS NATIVE VEGETATION

              FEASIBILITY INDEXES FOR THE CURRENT DATA
              ----------------------------------------

                1) NAT.VEG.                    2.184
                2) WILDLIFE                    2.117
                3) WAT.REC.                    2.061
                4) HIGH USE                    1.977 **
                5) CROPLAND                    1.938
                6) OTHER                        .000


 ======================================================================

  ** YOUR RESPONSE TO :
    VII) GROUND WATER HYDROLOGY
      E) ALLUVIAL VALLEY FLOOR
      WAS --> 1.) PRESENT.

    PRESENT ENVIRONMENTAL AND/OR LEGAL CONSTRAINTS PREVENT RECLAIMING
    TO THIS LAND USE OPTION UNLESS SPECIFIC REMEDIAL ACTIONS ARE TAKEN.


HIT THE RETURN KEY TO CONTINUE :
```

Figure 157. FEASI message for high human use (alluvium present).

land use. Since alluvium makes a poor substrate for building foundations, the specific action to be taken is to not selectively handle the alluvium. It should be mined in the normal manner, and mixed with shales and sandstones beneath it, to help reduce its water holding nature.

The resulting TECON list reflects this recommendation in that no cost is calculated for rehandling alluvium (Fig. 158). The TECON list for the other 4 land uses, however, does show a large alluvium rehandle cost (see Fig. 159 for the cropland example). This is because, by placing the alluvial material back on the surface of the spoil, the hydrologic characteristics will be more or less restored, which enhances the site's capability to support these land uses. The cost for such a plan is, however, quite high.

(e) If the user selects a mining stage for the dragline type mine that does not lend itself to being graded flat (such as opening cut or final cut spoils), the FEASI and TECON systems will flag the cropland and high use options as not being suitable. Figure 160 is an example for the opening cut mining stage, with a TECON message. OPUSE also will then skip these land uses. Truck and shovel spoils grading is more versatile, so opening cut and final cut spoils grading do not prohibit any land use.

G. Grade Spoils Only (CLAIM Executive Option 6)

The grade spoils only option is provided for the user who wishes to calculate spoils grading volumes and costs completely independent of the rest of CLAIM. The user may analyze each of the three main mining stages for both dragline and truck and shovel mines (Fig. 161).

Operation of the GRADE subsystem is identical to that described previously under the discussion on data input of the general mine description, but with two important exceptions. First, there are no set minimum or maximum limits on how the spoils should be graded (other than mathematical limits, such as trying to grade spoils steeper than they were, or trying to grade the opening or final cut dragline spoils to 0 degree slopes). Figure 162 is a graph of final cut spoils grading volumes ranging all the way from the beginning slope down to 4 degrees. Secondly, no default slope values are recommended in the Grade spoils only option. Thus, these recommendations do not appear when the user is inputting his final graded slopes (compare Figs. 163 and 58).

Both of these differences are designed to let the user have more flexibility in applying the GRADE program. For instance, the final cut dragline routines could be used to calculate the spoils grading volumes and costs for coal haulage ramp roads, when the mine is finished.

TYPICAL NORTHERN GREAT PLAINS NATIVE VEGETATION

*** HIGH USE ALTERNATIVE ***

TECHNIQUE	COST/ACRE
1)STRIP ALL TOPSOIL	$ 887.33
2)RESPREAD ALL TOPSOIL	$ 665.50
3)STRIP 1 FOOT OF SUBSOIL	$ 968.00
4)RESPREAD 1 FOOT OF SUBSOIL	$ 726.00
5)GRADE SPOIL	$ 1177.60
6)CHISEL PLOW	$ 10.50
7)DISC AND HARROW	$ 3.75
8)BUY SEED	$ 40.00
9)DRILL SEED	$ 3.75
10)BUY FERTILIZER : NITROGEN	$ 9.00
11)BUY FERTILIZER : PHOSPHATE	$ 7.00
12)DRILL FERTILIZER	$ 1.00
13)BUY HAY MULCH	$ 37.50
14)APPLY HAY MULCH	$ 30.00
15)HAND PLANT SHRUB AND TREE SEEDLINGS	$ 150.00
16)BUY,APPLY HERBICIDE	$ 2.75
17)ERECT ANIMAL FENCING	$ 40.00
18)STABILIZE TOPSOIL STORAGE PILE	$ 14.52
19)ADMIN. OF OPERATIONS AND NECESSARY TESTS	$ 716.13
	=========
TOTAL	$ 5490.34

GRAND TOTAL COST FOR 300.0 ACRES IS 1.65 MILLION DOLLARS

** THIS LAND USE OPTION ASSUMES THAT THE
ALLUVIAL VALLEY FLOOR CAN BE LEGALLY ELIMINATED.

Figure 158. TECON list for the high use option, where alluvium is <u>not</u> selectively handled.

TYPICAL NORTHERN GREAT PLAINS NATIVE VEGETATION

*** CROPLAND ALTERNATIVE ***

TECHNIQUE	COST/ACRE
1)STRIP ALL TOPSOIL	$ 887.33
2)RESPREAD ALL TOPSOIL	$ 665.50
3)STRIP 1 FOOT OF SUBSOIL	$ 968.00
4)RESPREAD 1 FOOT OF SUBSOIL	$ 726.00
> REHANDLE LITHOLOGIC UNIT # 1	$ 6453.33
5) TOTAL REHANDLE COST IS 6453.33 DOLLARS/ACRE	
6)GRADE SPOIL	$ 1231.31
7)CHISEL PLOW	$ 10.50
8)DISC AND HARROW	$ 3.75
9)BUY SEED	$ 4.00
10)DRILL SEED	$ 3.75
11)BUY FERTILIZER : NITROGEN	$ 9.00
12)BUY FERTILIZER : PHOSPHATE	$ 7.00
13)DRILL FERTILIZER	$ 1.00
14)BUY HAY MULCH	$ 37.50
15)APPLY HAY MULCH	$ 30.00
16)BUY,APPLY HERBICIDE	$ 2.75
17)ERECT ANIMAL FENCING	$ 40.00
18)STABILIZE TOPSOIL STORAGE PILE	$ 10.92
19)ADMIN. OF OPERATIONS AND NECESSARY TESTS	$ 1663.75
	=========
TOTAL	$ 12755.41

GRAND TOTAL COST FOR 300.0 ACRES IS 3.83 MILLION DOLLARS

Figure 159. Reclaiming to cropland, with a selective rehandle of alluvium.

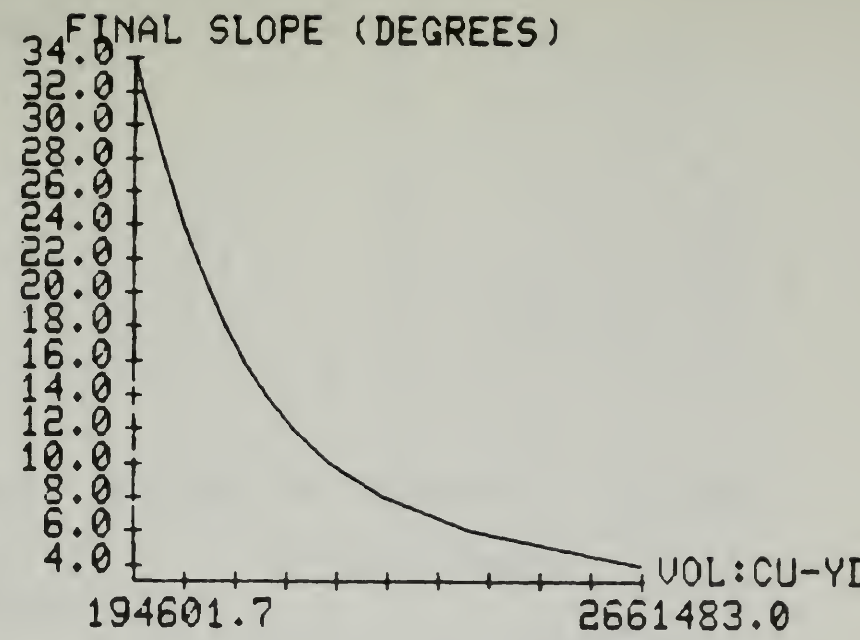
```
VGO FILE ENVIRONMENTAL DATA RESPONSES

        *** CROPLAND ALTERNATIVE ***

  REGARDLESS OF OTHER ENVIRONMENTAL CONSIDERATIONS
  REFLECTED IN THE FEASIBILITY RANKING,  THE TECHNIQUES
  LIST IS NOT AVAILABLE FOR THIS ALTERNATIVE BECAUSE :

      ** THE HIGHWALL AND SPOIL PILE ASSOCIATED WITH
         THIS BOX CUT CANNOT BE GRADED TO THE
         MAXIMUM SLOPE  (5.7 DEGREES/8 PERCENT) REQUIRED
         TO FEASIBLY RECLAIM TO THIS ALTERNATIVE.

      ** GRADING COSTS HAVE NOT BEEN COMPUTED FOR
         THIS ALTERNATIVE
```

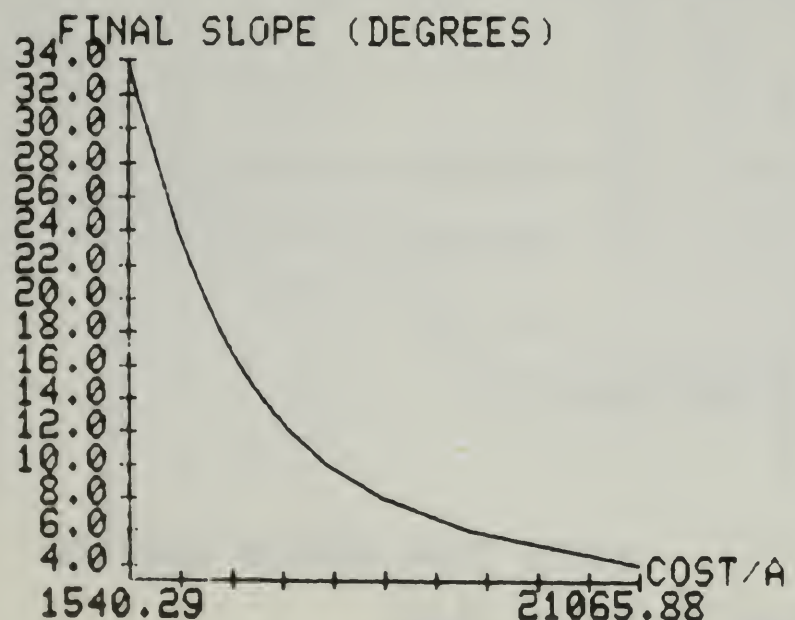
Figure 160. TECON message prohibiting cropland on the opening cut spoils (dragline mine).

```
******************************
*                            *
*           CLAIM            *
*                            *
*  COMPUTERIZED RECLAMATION  *
*      PLANNING SYSTEM       *
*                            *
******************************
---------------
 GRADE SPOILS
---------------

0 -> EXIT FROM GRADE SPOILS OPTION

1 -> DRAGLINE - OPENING CUT OPTION

2 -> DRAGLINE - MINE RUN OPTION

3 -> DRAGLINE - FINAL CUT OPTION

4 -> TRUCK AND SHOVEL - OPENING CUT OPTION

5 -> TRUCK AND SHOVEL - MINE RUN OPTION

6 -> TRUCK AND SHOVEL - FINAL CUT OPTION

ENTER YOUR SELECTION ->
```

Figure 161. Grade spoils only executive option list.

```
*** DRAGLINE - FINAL CUT ***

     CURRENT INPUT DATA :
 PIT BOTTOM WIDTH   : 120.00 FT
 PIT LENGTH         :1000.00 YD
 HIGHWALL HEIGHT    : 110.00 FT
 SPOIL BANK HEIGHT  : 130.00 FT
 HIGHWALL SLOPE     :  72.00 D
 SPOIL BANK SLOPE   :  34.00 D
 GRADING COST       :19.00 C/CY
HIT RETURN KEY TO CONTINUE ...
```





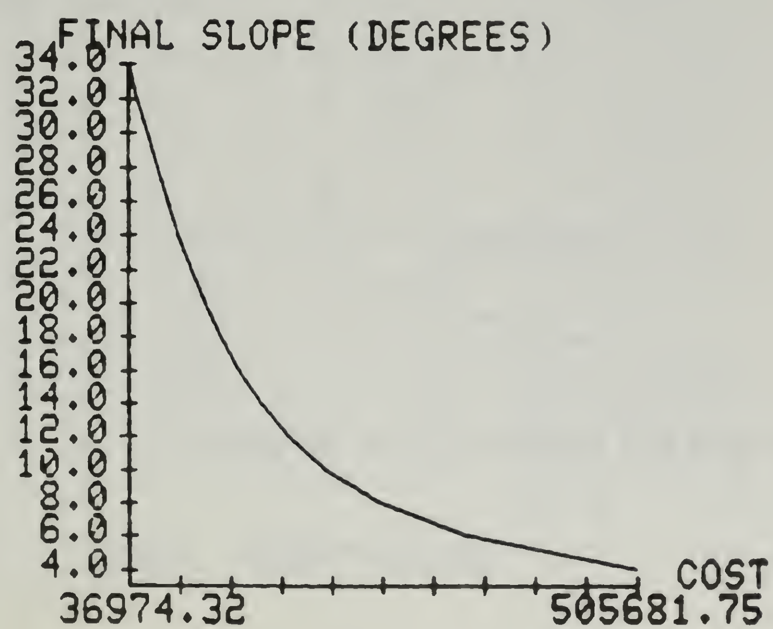
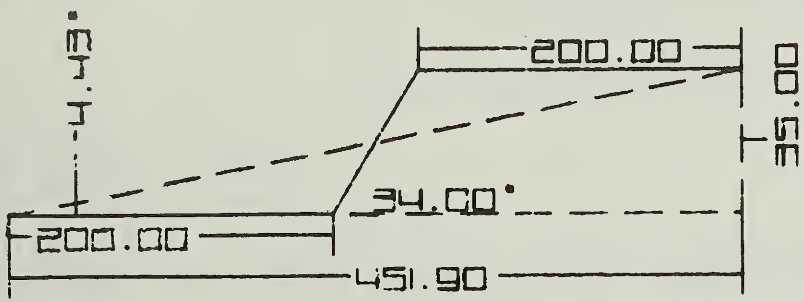


Figure 162. Volumes and costs for grading final cut spoils, with no limits.

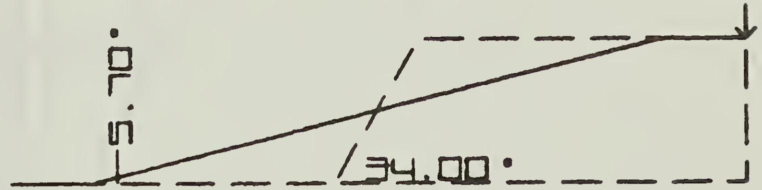
INPUT FINAL SLOPES

MINIMUM REQUESTABLE SLOPE



FINAL SLOPE VALUE

TERRACE # 1 WIDTH IS 50.59'



---------------------HIGHWALL # 1--------------------
THE CURRENT MINIMUM SLOPE OF 4.43 DEGREES WILL RESULT
IN A TERRACE # 1 WIDTH OF ABOUT ZERO.
THE MAXIMUM REQUESTABLE SLOPE IS -> 34.00 DEGREES

INPUT THE FINAL SLOPE (DEGREES) DESIRED ON HIGHWALL 1 -> 5.7

HIT RETURN KEY TO ERASE AND CONTINUE....

In operating GRADE independently of CLAIM data entries, one point should be remembered. If general mine description data were first entered for all 5 land use options through the data input executive of CLAIM they should be stored in a file, before running the GRADE option independently. If this is not done, cropland data will be lost, because GRADE sets cropland values to 0 when it is run independently. If the user forgets, and loses his cropland spoils data, they still may be reinput in the CLAIM edit executive.

For the user interested in operating GRADE only, the following Table 4 summarizes the output from this program.

Table 4. Summary of Output - GRADE.

(i) Dragline Mine - Opening Cut

A. Review graphs and table
1. Final desired slopes (10 equal increments) vs. volume to be graded
2. Final desired slope (10 equal increments) vs. total cost of grading
3. Final desired slope (10 equal increments) vs. width of base of spoil pile

B. For each of the chosen array of slopes for whole area (max. 10 slopes)
1. Total volume of spoil to be graded
2. Total cost of grading the spoil
3. Total width of spoils bank
4. Average cost per acre of grading the spoil

C. For grand total of all slopes
1. Total volume graded
2. Total cost of grading
3. Average cost/acre of grading

(ii) Dragline Mine - Mine Run

A. Review graphs and table
1. Final desired slopes (10 equal increments) vs. volume to be graded
2. Final desired slope (10 equal increments) vs. total cost of grading
3. Final desired slope (10 equal increments) vs. total cost/acre

B. For the chosen array of slopes for whole area (max. 10 slopes)
1. Total volume of spoil to be graded
2. Total cost of grading the spoil
3. Average cost per acre of grading the spoils

C. For grand total of all slopes
   1. Total volume graded
   2. Total cost of grading
   3. Average cost/acre of grading

(iii) Dragline Mine - Final Cut
   A. Review graphs and table
      1. Final desired slopes (10 equal increments) vs. volume to be graded
      2. Final desired slope (10 equal increments) vs. total cost of grading
      3. Final desired slope (10 equal increments) vs. total cost/acre

   B. For the chosen array of slopes for whole area (max. 10 slopes)
      1. Total volume of spoil to be graded
      2. Total cost of grading the spoil
      3. Average cost per acre of grading the spoil

   C. For grand total of all slopes
      1. Total volume graded
      2. Total cost of grading
      3. Average cost/acre of grading

(iv) Truck and Shovel - Opening Cut Spoil
   A. For each of the slopes chosen for the final benches
      1. Volume of spoil to be graded
      2. Cost of grading the spoil
      3. Bench length (semi-circular spoils)
      4. Terrace width left per bench

   B. For the grand total of all benches
      1. Total volume graded
      2. Total grading cost
      3. Total cost per acre of grading
      4. Total acres covered

(v) Truck and Shovel - Mine Run Spoil
   A. For each of the slopes chosen for the final benches
      1. Volume of spoil to be graded
      2. Cost of grading the spoil
      3. Bench length (semi-circular spoils)
      4. Terrace width left per bench
      5. Total cost for rehandled spoil

Table 4 Continued

B. For the grand total of all benches
   1. Total volume graded
   2. Total grading cost
   3. Total cost per acre of grading
   4. Total acres covered
   5. Grand total cost per acre

(vi) Truck and Shovel - Final Cut Spoil

A. For each of the slopes chosen for the final benches
   1. Volume of spoil to be graded
   2. Cost of grading the spoil
   3. Bench length (semi-circular spoils)
   4. Terrace width left per bench
   5. Total cost for rehandled spoil

B. For the grand total of all benches
   1. Total volume graded
   2. Total grading cost
   3. Total cost per acre of grading
   4. Total acres covered
   5. Grand total cost per acre

IV. REFERENCES, LOGIC, AND ASSUMPTIONS UNDERLYING CLAIM

A. FEASI Subsystem

It must be emphasized that CLAIM is a system for planning the most efficient reclamation goals and techniques, and not an environmental impact monitoring or control system. It is assumed that required environmental impact studies have been performed, and that mining of the area is generally deemed feasible by the company and regulatory agencies.

This system is "goal oriented", in that all reclamation plans should be directed toward a final land use goal (National Academy of Sciences 1974, Dick and Thirgood 1975). On the basis of logic, and new Federal reclamation laws, five major land use goals are identified in the system. These are: (1) cropland (including grain and hayland); (2) native vegetation (primarily native range, but can include riparian and upland woodlands); (3) wildlife habitat (for both game and non-game species); (4) outdoor recreation (primarily water-oriented); (5) intensive human use (including the construction of foundations for homes, businesses, and roads). A sixth, optional goal, which may be entered by the user, also is allowed by the system.

1. CLAIM Data Sources

The primary inputs to the CLAIM system are "critical operations and environmental data" (see User's Databook for a current list of these data). The data items were selected on the basis of literature surveys and field experience, and are deemed to be <u>absolutely essential</u> in determining if the area, after mining, can be reclaimed to one of the major land uses. The proof of "absolutely essential" data is based on two criteria: (a) much research throughout the Northern Great Plains has shown the parameter to be definitely harmful or helpful in establishing a final land use; (b) research has been done whereby the quantity or quality of that parameter has been modified, and a definite, repeatable response on the part of the land use material (such as vegetation) has been observed. A good example of this type of datum is soil salinity. Highly saline (electrical conductivity of greater than 16 mmhos per cm) spoils are known to be very limiting to plant growth. By burying these materials under non-toxic soil materials, this inhibitor of plant survival can be eliminated.

The critical data required for the databook were gleaned from an extensive literature survey (see Bituminous Coal Research, Inc. (1975), Boyd and Schillinger (1977), Honkla (1974), and University of Arizona (1977) for examples of bibliographies), with the best sources being major review papers. The purpose of this User's Manual is not to present a complete review of the reclamation literature for the Northern Great

Plains, but the following references were of significant value in preparing the critical data list, as well as developing the logic underlying the TECON calculations for reclamation techniques and costs. The more comprehensive sources which were used included:

(a) Climatology - Gardner and Woolhiser (1978), George (1971), Packer (1974), Skidmore and Woodruff (1968), Woodruff and Skiddoway (1965), and Woodruff et al. (1977).

(b) Soils - Anonymous (1977), Arnold and Dolhopf (1977), Berg (1980), Cook et al. (1974), Hodder (1975), Omodt et al. (1975), Power et al. (1976), Ries et al. (1977), Sandoval and Gould (1978), Schafer et al. (1976), and Schuman et al. (1976).

(c) Overburden - Dollhopf et al. (1977, 1977a), Dollhopf et al. (1978), Sandoval et al. (1973), Simpson (1980), and Winczewski (1978).

(d) Surface Water Hydrology - Hardaway (1977), Hasfurther and Akerbergs (1979), Hasfurther and Rechard (1977), and U.S. Dept. of the Interior (1975).

(e) Ground Water Hydrology - Davis and Rechard (1977), U.S. Geological Survey (1974), Van Voast (1974), Van Voast and Hedges (1975), and Van Voast et al. (1977).

(f) Vegetation - DePuit and Dollhopf (1978), DePuit et al. (1978), Dollhopf and Majerus (1975), Donovan et al. (1976), May et al. (1971), National Academy of Sciences (1974), Packer (1974), U.S. Dept. of Agriculture (1975), and Vories and Sims (1977).

(g) Wildlife - Harju (1980), Lynott (1977), Morgan (1973), Scott and Terrel (1976), and Terrel and Shinn (1977).

(h) Socio-Economics - Holmberg et al. (1978), LaFevers and Imhoff (1977), National Academy of Sciences (1974), U.S. Geological Survey (1979), and Williams (1975).

(i) Mining Techniques and Costs - Fluor Utah and Bonner and Moore, Associates (1977), Imhoff et al. (1978), Luft and Schaefer (1977), Morey and Draffin (1977), Persse (1975), Persse et al. (1977), Poyser et al. (1976), Riddle and Saperstein (1978), Smith (1976), U.S. Dept. of Interior Bureau of Mines (1976), and Watts (1975).

Most of these critical operations and environmental data are also based on the author's experience in the coal mining industry, as well as on interviews with many other practicing reclamation managers currently working with surface coal mines.

2. Feasibility Calculation (FEASI value)

Within the CLAIM system, each critical environmental parameter is broken down into logical categories - usually based on the literature sources. Each category can then be ranked by a simple numerical system according to generally how feasible it would be to return a parcel of land with that environmental condition back to one of the main land uses. The reclamation manager may insert his own rank values in the system, or he may rely on the default ranking values already programmed (see Table 5 for a hypothetical example of the ranking system). The 5 ranking numbers are based on relative expectations of success, given a certain environmental condition. They are: 0 - no expectation of success - such as growing grain crops on 19 degree slopes; 1 - negative expectation of success - such as growing crops on 11 degree slopes; 2 - neutral expectation of success - such as growing crops on 5 degree slopes; 3 - positive expectation of success - such as growing crops on flat land; 4 - must achieve that goal (required by reclamation laws - such as the pre-mining presence of "prime agricultural lands)."

Table 5. Sample feasibility ranking system.

	Value Observed	Cropl.	Native Veg.	Wildl.	Recr.	Int. Use	Other
A.	Average Total Annual Precip. (in.)						
___	1. 5.0 - 10.0	1	1	1	1	1	-
___	2. 10.1 - 15.0	1	2	2	2	2	-
X	3. 15.1 - 20.0	3	3	2	2	1	-
___	4. 20.1 - 25.0	3	3	2	2	1	-
B.	Topsoil Sodium Adsorption Ratio (meq/L)						
___	1. .1 - 4.9	3	3	3	3	3	-
___	2. 5.0 - 9.9	2	2	2	2	2	-
___	3. 10.0 - 14.9	1	1	2	1	2	-
X	4. 15.0 +	0	2	2	2	1	-
	Total Value Observed	3	5	4	4	2	-
	Average Value Observed (For FEASI)	1.5	2.5	2.0	2.0	1	-

Land-use Ranking: Cropl., Native Veg., Wildl., Recr., Int. Use, Other

The FEASI system is designed to sum and average the ranking values for the appropriate categories observed for all of the critical environmental parameters in the databook. (The expectation of success values for all overburden units are added together and averaged separately to produce one real number value for each of the overburden parameters. These numbers are then averaged in with the rest of the CLAIM parameters. This prevents undue weight being placed on overburden characteristics, when many lithologic units are encountered.) For the two hypothetical environmental conditions and rankings in Table 5, native vegetation (average value 2.5) is the "most feasible" land-use option. This is followed by wildlife and recreation, then cropland, and lastly, intensive human use.

There are two main assumptions in the feasibility system. One is that all of the environmental parameters are of equal importance to the reclamation effort. This may not always be true, but hard data showing the exact relative importance of each parameter are lacking. Also, the user should remember that Liebig's "Law of the Minimum" applies to ecological, as well as physiological, systems. The second assumption is that, generally, the most feasible reclamation option is the pre-mining land use; but, the spoil is a resource, and almost any land use can be developed (within legal constraints) if enough effort and money is spent.

B. TECON Subsystem

The most environmentally feasible reclamation option may not always be the most economical, so a second feature of the CLAIM system is to produce a set of preferred techniques, and costs, for each of the five land-use options. The preferred methods are related to the given set of environmental conditions by a detailed set of programmed assumptions which, in turn, are based on proven field techniques reported in the literature reviewed previously. This section uses tables and narrative to describe the assumptions and logic underlying the functioning of TECON.

1. General TECON Operation

There are 4 main interlocking components used in the operation of the TECON subsystem. These are: (a) the user's databook answers to environmental categories, headings, and subheadings; (b) a master list of all reclamation techniques and cost calculations; (c) a default list of "standard" reclamation techniques for a non-problem site; and (d) a problem conditions searching routine. The overall integration of these is as follows: The computer stores a file of all of the basic, proven reclamation techniques normally used in the Northern Great Plains, with

instructions on how to calculate general costs per acre for employing each technique (see Table 6 following). These costs are calculated later by the program, depending on what land use is being considered, and also depending on what mix of topography the user finally selects for each land use. Some of the costs are calculated directly from an actual value entered in the databook. For instance, the actual thickness of the topsoil (databook item III,A,7) is used to determine topsoil storage costs.

The computer also contains 5 default lists (one for each land use) of standard reclamation techniques which would be used on a typical Northern Great Plains site that had no serious or unusual environmental problems (see Tables 7 and 8). This list is used initially, but the computer then searches the user's answers to databook questions, to see if any environmental conditions occur which might require different reclamation techniques. The computer first looks for single "problem" factors (Table 9), and then looks for <u>significant combinations</u> of factors that, interactively, may cause a problem (Table 10). If such problem environmental factors are found they, in turn, cause the program to either add <u>and/or</u> subtract reclamation techniques to the initial default list. (In some cases, different kinds of problems will call for the same reclamation technique to be added or subtracted from the default list more than once. Since the same technique will solve both problems at once, it is employed only when called for the first time.) Once the finalized list is developed, the computer searches the master list for each technique that is required, for each land use, and calculates its cost - again based on the land use and the topography selected by the user for that land use (within reasonable limits).

These technique costs are then summed, the acreage is determined from the operation of the GRADE routines, and a final total cost and cost per acre is calculated for the TECON printout.

Specific details of the logic behind the components is presented below. The user should refer to the databook when reference is made to its categories.

2. Master list of reclamation techniques and cost calculations for each land use.

Table 6 summarizes the reclamation techniques and cost master list. The user should note that many costs depend upon the final topography - particularly what percent of the area is greater than or equal to 19 degrees. The CLAIM system, therefore, operates the GRADE routines first, to determine the topography mix. After this, costs for each technique, for each land use, may be determined.

Reclamation technique costs are based on 1979 custom rates - that is, what the current cost would be to hire someone to perform the technique in the 1979 farm marketplace. However, some mines have found it hard to hire this work out - particularly at the season when it needs to be done. Their only recourse has been to buy their own reclamation-farm machinery, and hire permanent help. Since this equipment often sits idle for most of the year at a mine, the ownership costs will be high. This added cost is not included in the table. If the user has this kind of situation, he should calculate these costs for his machinery, and add this in to the costs produced by CLAIM. Another way to handle this is to edit the basic TECON costs per acre, to reflect the user's higher costs (see the CLAIM edit executive).

The following lists the assumptions that underly the reclamation cost calculations in Table 6:

(a) Topsoil management

1,2) Strip and respread all topsoil. This surface material (having greater than 0.1 percent organic matter) is preferred as a plant growth medium. Slopes greater than or equal to 19 degrees are not topsoiled and are managed as natural overburden outcrops (only on native vegetation, wildlife, and recreation land uses).

(b) Subsoil management

1,2) Strip and respread 1.0 feet of subsoil (B horizon). This is an adequate amount for plant root growth when 1.0-1.9 feet of topsoil is present. Slopes greater than or equal to 19 degrees are not subsoiled and are managed as overburden outcrops (only on native vegetation, wildlife, and recreation land uses).

3,4) Strip and replace two feet of subsoil, or a subsoil-topsoil blend. This is done when an insufficient amount of topsoil is present. Slopes greater than or equal to 19 degrees are managed as overburden outcrops (for native vegetation, wildlife, or water based recreation land uses).

(c) Overburden management

1) Rehandle whole layer. The whole lithologic unit is rehandled if it is toxic for 1 or more parameters and if it constitutes more than 15 percent of the total overburden thickness (Dollhopf et al. 1978). Thinner toxic units are simply diluted by normal spoiling techniques.

2) Rehandle two feet of seedbed-suitable spoil. This is done only if both surface soil and subsoil are poor growth media.

3) Grade spoil. Generally, agricultural and high use lands should be flatter, while wildlife, native vegetation, and recreation areas should be more hilly (Persse et al. 1977). Therefore, optional default slope sets for both dragline and truck and shovel mines have been provided for the user (see data input section of CLAIM). These default sets help determine what the topography will be like for each of the five land use options, and therefore determine what the grading costs will be - through the operation of the GRADE subroutine. Once the topography is defined, the application of many other reclamation techniques can be determined. In many instances, a given technique either can, or cannot, be used on steep slopes (greater than or equal to 19 degrees), and this helps determine the reclamation technique to be used for the land use having that kind of slope. The default values are used to encourage the creation of real differences between different land use plans. For example, it would be overly costly to grade an area flat and then call it a wildlife area - as well as probably being poor habitat for most animal species.

4) Rip 3 foot centers. The average cost per acre to rip spoils is $450.00, which is required if the bulk density is over 1.50 g/cc. Areas with slopes greater than or equal to 19 degrees (simulating rock outcrops) are not ripped. Ripping is used to provide a good contact zone between soil materials and the spoil, and it also permits better root penetration.

(d) Seedbed preparation

1) Chisel plow. The custom rate for chisel plowing is $10.50 per acre, which is done to help prepare the seedbed. Steep slopes (greater than or equal to 19 degrees) cannot be plowed due to machinery access problems.

2) Disc and harrow. The custom rate is $3.75 per acre for this seedbed preparation. Steep slopes (greater than or equal to 19 degrees) are not tilled in this way because of machinery access problems.

3) Chaining. Use of a spiked chain for seedbed preparation costs about $15.00 per acre. This is used only on steeper (greater than or equal to 19 degrees) slopes, which are not present on cropland or high use areas.

(e) Seeding

1) Buy seed. Wheat seed for cropland costs about $4.00 per acre. For the other four land uses, slopes less than 19 degrees are drill seeded at about 16 lb/acre, equalling a $40.00 cost/acre. Slopes greater than or equal to 19 degrees are hydromulch broadcast seeded at about 32 lb/acre, equalling a $80.00 cost/acre.

2) Drill seed. All slopes less than 19 degrees should be drill seeded for most reliable results. The cost is about \$3.75 per acre.

3) a,b. Soils "low" in nitrogen need 45 pounds per acre added; soils "medium" in nitrogen need 20 pounds per acre; soils "high" in nitrogen need 5 pounds per acre added. At current costs, these nitrogen application rates cost \$9.00, \$4.00, and \$1.00 per acre, respectively. Phosphate application rates for low, medium, and high fertility soils are 50, 20, and 5 pounds per acre, costing \$7.00, \$2.80, and \$.75, respectively. These rates are assuming the establishment of a non-irrigated grass-legume vegetative cover.

4) Drill fertilizer. All slopes less than 19 degrees should have the fertilizer drilled (usually with the seed), costing \$1.00 per acre.

5) Buy hay mulch. Hay mulch should be purchased for all areas having slopes less than 19 degrees, at the rate of 2.5 tons per acre, costing \$45.00 per ton.

6) Apply hay mulch. Hay mulch should be applied even to level areas in the windy Northern Great Plains, and to all slopes less than 19 degrees in steepness. This costs about \$30.00 per acre.

7) Hydromulch seed and fertilizer. All slopes of 19 degrees (or greater) must be mulched, seeded, and fertilized with a hydromulching machine because drill equipment cannot obtain safe access to the hill. The cost is \$400.00 per acre.

8) Hand plant shrub and tree seedlings. Hand planting of shrub and tree seedlings for wildlife food and cover costs about \$150.00 per acre at a rate of 100 seedlings per acre. This technique is not generally used on cropland areas.

(f) Protect seedlings

1) Buy and apply herbicide. This should be done for cultivated plants to eliminate weed competition. A standard broadleaf weed herbicide costs \$2.75 per acre to buy and apply. This should not be done on wildlife and native vegetation areas, where native species are encouraged.

2) Erect animal fencing. If livestock or wildlife will destroy new plantings, this costs about \$40.00 per acre, assuming a block of reclaimed land 40 acres in size.

(g) Climate management

1) Snow fencing. 1320 feet of snow fence is required to collect snow per 40 acre block at $.50 per foot, if windy conditions exist.

2) Seed nurse crop. A "nurse" crop to protect plantings from wind, and collect snow moisture, costs about $6.75 per acre to buy and drill the seed. This is not used for cropland.

3) Irrigate plantings. If plantings are irrigated because of low precipitation, this costs about $33.00 per acre assuming a movable pipe system on a 160 acre size field, with water supplied. Slopes greater than or equal to 19 degrees should not be irrigated, due to erosion problems.

(h) Stabilization of the topsoil storage pile (for erosion control)

1) This usually requires the same planting operations and costs used to establish cropland on the area. About one acre of topsoil storage pile is required for every 10 acres of land reclaimed.

(i) Administration costs

1) Overseeing of the reclamation operations, and obtaining necessary permits and bonds, is equal to about 15 percent of the base reclamation cost. This also includes various soils, water, and seed tests, as outlined in the U.S. Bureau of Mines information circular on mine reclamation costs (Persse et al. 1977).

3. Standard Default Techniques List

Under "normal" conditions, where no unusual or harmful environmental conditions are encountered, the following basic techniques are used (Table 7). These are coded to the master list (Table 6) in Table 8.

Table 6. Master list of reclamation techniques and cost calculations per acre. Numerals refer to databook categories, headings, and subheadings.

Category (Technique)	Cost per Acre - Calculations: Cropl.	Native Veg.	Wildl.	Water Recr.	High Use Structures
a. Topsoil Management					
1) Strip all topsoil	III,A,5 (X) III,A,7 (X) 1.344 Crop., High use				
	same (-) (same x % area $\geq$ 19 deg.) Nat. veg., Wildl., Recr.				
2) Respread all topsoil	III,A,6 (X) III,A,7 (X) 1.344 crop., high use				
	same (-) (same x % area $\geq$ 19 deg.) nat. veg., wildl., recr.				
b. Subsoil Management					
1) Strip 1.0 ft. subsoil	III,A,5 (X) 16.133 crop., high use				
	same (-) (same x % area $\geq$ 19 deg.) nat. veg., wildl., recr.				
2) Respread 1.0 ft. subsoil	III,A,6 (X) 16.133 crop., high use				
	same (-) (same x % area $\geq$ 19 deg.) nat. veg., wildl., recr.				
3) Strip 2.0 ft. subsoil or a	III,A,5 (X) 32.266 crop., high use				
2 ft. topsoil-subsoil blend	same (-) (same x % area $\geq$ 19 deg.) nat. veg., wildl., recr.				
4) Respread 2.0 ft. subsoil or a	III,A,6 (X) 32.266 crop., high use				
2 ft. topsoil-subsoil blend	same (-) (same x % area $\geq$ 19 deg.) nat. veg., wildl., recr.				
c. Overburden Management					
1) Rehandle whole layer	I,A,3 (X) V,B,n (X) 16.133 for all five uses				
2) Rehandle 2 ft. of seedbed suitable spoil	I,A,3 (X) 32.266 for all five uses				
3) Grade spoil	Run GRADE using 5 slope sets input by user				
4) Rip 3 ft. centers	450.00	450.00 (-) (450 x % area $\geq$ 19 degrees)			450.00
d. Seedbed Preparation					
1) Chisel plow	10.50	10.50 (-) (10.50 x % area $\geq$ 19 degrees)			10.50
2) Disc and harrow	3.75	3.75 (-) 3.75 x % area $\geq$ 19 degrees)			3.75
3) Chaining	N.A.	15.00 (X) % area $\geq$ 19 degrees)			N.A.

Table 6 Continued

Category (Technique)	Cost per Acre - Calculations				
	Cropl.	Native Veg.	Wildl.	Water Recr.	High Use Structures
e. Seeding					
1) Buy seed	4.00	40.00 (-) (40 x % area < 19 deg.) (+) (80.00 x % area ≥ 19 deg.) nat. veg., wildl. recr. high use			
2) Drill seed	3.75	3.75 (-) (3.75 x % area ≥ 19 deg.)			3.75
3) Buy fertilizer					
a) Nitrogen	If III,H,1 - 9.00; If III,H,2 - 4.00; If III,H,3 - 1.00 (for all)				
b) Phosphate	If III,I,1 - 7.00; If III,I,2 - 2.80; If III,I,3 - .75 (for all)				
4) Drill fertilizer	1.00	1.00 (-) (1 x % area ≤ 19 deg.)			1.00
5) Buy hay mulch	112.50	112.50 (-) (112.50 x % area ≥ 19 deg.)			112.50
6) Apply hay mulch	30.00	30.00 (-) (30 x % area ≥ 19 deg.)			30.00
7) Hydromulch seed and fertilizer	N.A.	400.00 (X) % of area ≥ 19 deg.)			N.A.
8) Hand plant shrub and tree seedlings	N.A.	150.00	150.00	150.00	150.00
f. Protect seedlings					
1) Buy, apply herbicide	2.75	N.A.	N.A.	2.75	2.75
2) Erect animal fencing	40.00	40.00	40.00	40.00	40.00
g. Climate management					
1) Snow fencing	16.50	16.50	16.50	16.50	16.50
2) Seed "nurse" crop	N.A.	6.75	6.75	6.75	6.75
3) Irrigate plantings	33.00	33.00 (-) (33 x % area ≥ 19 deg.)			33.00
h. Stabilize Topsoil storage pile					
1) Same operations used to establish cropland on area	Repeat techniques from this table. d.1,2, + e.1,2,3a,b,4,5,6 + f.1 (X) .10 (for all)				
i. Administration costs					
1) Overseeding all operations and necessary tests, plus bond and permit fees	Total costs obtained through h in this table (X) .15 (for all)				

Table 7. Verbal list of standard reclamation techniques.

Cropland	Native Veg.	Wildlife	Water Recr.	High Use
Strip all topsoil	same	same	same	same
Respread all topsoil	same	same	same	same
Strip 1 foot subsoil	same	same	same	same
Replace 1 foot subsoil	same	same	same	same
Grade spoil	same	same	same	same
Chisel plow	same	same	same	same
Disc and harrow	same	same	same	same
---	chain slopes $\geq 19^{o}$	same	same	--
Buy seed	same	same	same	same
Drill seed	same	same	same	same
Buy nitrogen	same	same	same	same
Buy phosphate	same	same	same	same
Drill fertilizer	same	same	same	same
Buy hay mulch	same	same	same	same
Apply hay mulch	same	same	same	same
---	hydromulch-seed fert.	same	same	--
---	plant shrubs, trees	same	same	same
Buy, apply herbicide	--	--	buy,apply herb.	same
Stabilize topsoil pile	same	same	same	same
Program administration	same	same	same	same

Table 8. Default techniques list assuming no unusual environmental conditions are found (coded to Table 6).

Land Use				
Cropland	Native veg.	Wildlife	Water Recr.	High Use
a-1,2	a-1,2	a-1,2	a-1,2	a-1,2
b-1,2	b-1,2	b-1,2	b-1,2	b-1,2
c-3	c-3	c-3	c-3	c-3
d-1,2	d-1,2,3	d-1,2,3	d-1,2,3	d-1,2
e-1,2,3a, 3b,4,5,6	e-1,2,3a,3b 4,5,6,7,8	e-1,2,3a,3b, 4,5,6,7,8	e-1,2,3a,3b, 4,5,6,7,8	e-1,2,3a, 3b,4,5,6,8
f-1			f-1	f-1
h-1	h-1	h-1	h-1	h-1
i-1	i-1	i-1	i-1	i-1

4. Single problem environmental conditions encountered which require special reclamation techniques.

The following lists single conditions (from the databook) which require special reclamation techniques, and explains why. This narrative is coded to the master techniques list in Table 9.

a. Climate

(1) II,B,3 - Mean annual wind velocity 10.1-15.0 mph. To prevent excessive loss of soil and snow, snow fencing should be established at least on areas reclaimed for cropland and native vegetation.

(2) II,B,4 - With a mean annual wind velocity over 15.1 mph, all land use options should be protected by snow fencing to prevent soil erosion and loss of snow moisture. In addition, wildlife and native vegetation sites should be further protected by the planting of an annual nurse crop, such as wheat, barley or oats.

b. Topsoil

(1) III,A,4 - If the average premining topsoil thickness is greater than or equal to 2 feet, this material should be saved, and saving a foot of subsoil is not necessary for satisfactory plant growth - for all land uses.

c. Overburden

For all overburden parameters, the problem unit must comprise at least 15 percent of the total overburden thickness, before a rehandle will be done.

(1) V,A,3 - If, after final grading, the current mine plan results in 101-1000 rocks per acre on the surface, then the primary lithologic unit causing the rockiness must be buried, usually by a rehandle process, if cropland is to be established.

(2) V,A,4 - If the current mine plan results in over 1000 rocks per acre on the surface, then the primary responsible lithologic unit must be buried by rehandling - for all land use options.

(3) V,D,2 - If the average bulk density of the final graded spoil is greater than or equal to 1.50 g/cc, the spoil surface should be ripped to allow more root penetration, as well as provide a good contact zone with soil layers - preventing later slippage, for all land uses, except high human use (for structures).

(4) V,E,3 - If the average surface spoil has an electrical conductivity (EC) value greater than or equal to 4.1 mmhos/cm, and cropland is to be established, then the primary lithologic unit causing the saline conditions must be buried by rehandling.

(5) V,E,4 - If the average surface spoil has an EC value greater than or equal to 8.1 mmhos/cm, and cropland or native vegetation is to be established, then the responsible lithologic units should be buried by rehandling.

(6) V,E,5 - If the average surface spoil has an EC value greater than or equal to 16.1, and cropland, native vegetation, or wildlife management is the final desired land use, then the responsible lithologic units should be buried by rehandling.

(7) V,F,3 - If the average sodium adsorption ratio (SAR) value is greater than or equal to 10.0, the causative lithologic unit should be buried by rehandling, if cropland is to be established.

(8) V,F,4 - If the average SAR value is greater than or equal to 15.0, then the responsible lithologic unit should be buried by rehandling for all land use goals.

d. Groundwater hydrology

(1) VII,E,1 - If a minable alluvial valley is present, the alluvium should be rehandled and placed back on top - for all land uses but high use (foundations).

e. Vegetation

(1) VIII,A,5 - If a threatened or endangered plant species grows on the area it, and other members of its plant community, should be reestablished by hand planting. Also, the area should be fenced to prevent animal damage during plant establishment for all land uses. Cropland and high use are prohibited.

f. Wildlife

(1) IX,A,1 - If big game mammals are abundant all land use options should be fenced during seedling establishment.

(2) IX,A,5 - If threatened or endangered animal species exist in the area, suitable food and cover plants should be hand planted to insure fast recovery of the animal's habitat - for all land uses except high human use. High use is not compatible with maintenance of endangered species habitat. (The cropland would be strictly supportive of the animal's food needs.)

(3) IX,C,1 - If livestock are grazing on surrounding areas, the reclaimed area must be fenced to protect new plantings - for all land uses.

g. Socio-economics

(1) X,A,1 - Important archaeologic, historic, cultural, or scientific sites should be fenced, for all land use options.

(2) X,B,1 - Occurrence of "prime agricultural land" (defined by law) means that cropland is the only acceptable post-mining land use.

5. Significant combinations of conditions encountered in the databook which require special reclamation techniques from the master list.

The following lists multiple conditions (from the databook) which require special reclamation techniques, and explains why. This narrative is coded to the master techniques list in Table 10.

a. Topsoil, subsoil, and overburden quality for plant growth

(1) If a dragline is mining on slopes greater than 5.7 degrees, cropland and high use are not feasible, because the site cannot be economically graded flat enough.

(2) The second set determines if <u>any</u> especially harmful condition for cropland use exists in the topsoil which cannot be easily corrected, and, if so, then examines the subsoil to determine if it is suitable as a topsoil substitute for this land use.

Topsoil factors assumed to be detrimental to cropland establishment, and which can most readily be corrected by using another stratum for plant growth, are (from databook): Thickness $\leq$ 5.9 in; organic matter $\leq$ .09%; texture sandy, clay loam or clay, salinity $\geq$ 4.1 mmhos/cm; SAR $\geq$ 10.0 meq/L.

If the subsoil meets <u>all</u> of the following criteria, it can be substituted for the undesirable topsoil: Thickness $\geq$ 24 in; texture sandy loam, loam, or silt loam; salinity $\leq$ 4 mmhos/cm; SAR $\leq$ 9.9 meq/L. If the topsoil is just too thin, a lesser amount of subsoil may be saved, and blended with the topsoil to produce a satisfactory growth medium 2 feet thick.

Table 9. Single environmental conditions from databook which require special reclamation techniques.

Databook Answer	Add or subtract from techniques master list (Table 6)									
	Cropland		Native Veg.		Wildlife		Water Recr.		High Use	
	Add	Subtract	Add	Subtract	Add	Subtract	Add	Subtract	Add	Subtract
II B-3	g-1	--	g-1	--	--	--	--	--	--	--
II B-4	g-1	--	g-1,2	--	g-1,2	--	g-1	--	g-1	--
III A-4	--	b-1,2	--	b-1,2	--	b-1,2	--	b-1,2	--	b-1,2
V A-3	c-1	--	--	--	--	--	--	--	--	--
V A-4	c-1	--	c-1	--	c-1	--	c-1	--	c-1	--
V D-2	c-4	--	c-4	--	c-4	--	c-4	--	--	--
V E-3	c-1	--	--	--	--	--	--	--	--	--
V E-4	c-1	--	c-1	--	--	--	--	--	--	--
V E-5	c-1	--	c-1	--	c-1	--	c-1	--	c-1	--
V F-3	c-1	--	--	--	--	--	--	--	--	--
V F-4	c-1	--	c-1	--	c-1	--	c-1	--	c-1	--
VII E-1	c-1	--	c-1	--	c-1	--	c-1	--	--	--
VIII A-5	0[1]	0	f-2	--	--	--	--	--	0	0
IX A-1	f-2	--	f-2	--	f-2	--	f-2	--	f-2	--
IX A-5	e-8	--	--	--	--	--	--	--	0	0
IX C-1	f-2	--	f-2	--	f-2	--	f-2	--	f-2	--
X A-1	f-2	--	f-2	--	f-2	--	f-2	--	f-2	--
X B-1	--	--	0	0	0	0	0	0	0	0

[1] A "0" means that land use is incompatible with the environmental condition, so is prohibited.

(3) The third set in Table 10 again determines if any especially detrimental condition for cropland exists in the topsoil which cannot be easily corrected and, also, determines if any detrimental conditions exist in the subsoil which prevent its use as a substitute for the unsuitable topsoil. These subsoil conditions include: Thickness $\leq$ 23.9 in; texture sandy, clay loam or clay; salinity $\geq$ 4.1 hhmos/cm; SAR $\geq$ 10.0 meq/L. If both the topsoil and subsoil are unsatisfactory, then they are both discarded (not saved by scrapers), and a suitable 2 foot (or more) substitute is found from among the overburden layers. (It is assumed that at least one of the overburden layers will meet all acceptable criteria.)

(4) The fourth set repeats the process described for the first set, only this time for the land use goals of native vegetation, wildlife, or water-based recreation. Topsoil factors assumed to be detrimental to these land uses are (from the databook): Thickness $\leq$ 5.9 in; organic matter $\leq$ .09%; texture sandy or clay; salinity $\geq$ 8.1 mmhos/cm; SAR $\geq$ 10.0 meq/L. If the subsoil meets all of the following criteria, it can be substitutes for, or blended with, the undesirable topsoil: Thickness $\geq$ 24 in; texture sandy loam, loam, silt loam, or clay loam; salinity $\leq$ 16.0 mmhos/cm; SAR $\leq$ 14.9 meq/L.

(5) The fifth set in the table again determines if both the topsoil and subsoil are unsatisfactory plant growth media - this time for native vegetation, wildlife, and water-based recreation land uses. Undesirable characteristics of the topsoil are the same as for set 4, while undesirable characteristics of subsoil are: Thickness $\leq$ 23.9 in; texture sandy or clay; salinity $\geq$ 16.1 mmhos/cm; SAR $\geq$ 15.0. If both of these strata are unsuitable for reclamation, then a more desirable overburden layer is substituted.

(6) The sixth set repeats the process described in the second set, only this time for the land use goal of high human use for structures. Topsoil factors assumed to be detrimental to this land use are: Thickness $\leq$ 5.9 in; texture sandy or clay; salinity $\geq$ 16.1 mmhos/cm; SAR $\geq$ 15.0 meq/L.

If the subsoil meets all of the following criteria, it can be substituted for, or blended with, the undesirable topsoil. Thickness $\geq$ 24.0 in; texture sandy loam, loam, silt loam, or clay loam; salinity $\leq$ 16.0 mmhos/cm; SAR $\leq$ 14.9 meq/L.

(7) The seventh set of conditions again determines if both the topsoil and subsoil are unsatisfactory plant growth media - this time for the high human use option. Undesirable characteristics of the topsoil are the same as for set 6, while undesirable characteristics of subsoil are: Thickness $\leq$ 23.9 in; texture sandy or clay; salinity $\geq$ 16.1 mmhos/cm; SAR $\geq$ 15.0 meq/L.

b. Precipitation, groundwater, and surface water for plant irrigation

(8) The eighth set determines, from the databook, if the amount of annual precipitation is less than desirable for cropland establishment. In this case, the amount is less than or equal to 15.0 inches.

Next, the quantity and quality of both surface and groundwater supplies is examined, to determine if one of these sources can be used for irrigation. Desirable attributes of surface water are: amount available $\geq$ .26 acre feet per growing season; salinity $\leq$ 750 micro mhos/cm; SAR $\leq$ 18.0 meq/L. Desired attributes of groundwater are: amount available $\geq$ .26 acre feet per growing season; salinity $\leq$ 750 micro mhos/cm; SAR $\leq$ 18.0 meq/L. If all of the attributes are found in either source of water, then irrigation is a recommended technique for cropland under dry conditions. If not, cropland is harmed, but is not absolutely infeasible.

(9) The next set repeats the process described for the eighth set, this time for native vegetation and wildlife land uses. In this case, undesirable dryness is less than or equal to 10.0 inches of precipitation per year. Desirable characteristics of surface water are: amount available $\geq$ .11 acre feet per growing season; salinity $\leq$ 2,250 micro mhos/cm; SAR $\leq$ 26.0 meq/L. Desirable attributes of ground water are: amount available $\geq$ .11 acre feet per growing season; salinity $\leq$ 2,250 micro mhos/cm; SAR $\leq$ 26.0 meq/L. If all the attributes are found in either source of water, then irrigation is a recommended technique for native vegetation or wildlife management under dry conditions.

(10) The tenth set repeats the process described for the eighth set, this time for the water-based recreation land use option. In this case, undesirable dryness is $\leq$ 15.0 inches of precipitation per year. Desirable characteristics of surface water are: amount available $\geq$ .51 acre feet/growing season; salinity $\leq$ 2,250 micro mhos/cm; SAR $\leq$ 18.0 meq/L. Desirable attributes of groundwater are: amount available $\geq$ .51 acre feet/growing season; salinity $\leq$ 2,250 micro mhos/cm; SAR $\leq$ 18.0 meq/L. If all the attributes are found in either source of water, then irrigation (i.e. providing added water) is a recommended technique for water-based recreation under dry conditions.

(11) The last set repeats the process described for the eighth set, this time for the high human use reclamation option. In this case, undesirable dryness is less than or equal to 10.0 inches of precipitation per year. Desirable characteristics of surface water are: amount available $\geq$ .11; salinity $\leq$ 2,250 micro mhos/cm; SAR $\leq$ 26.0 meq/L. Desirable attributes of groundwater are: amount available $\geq$ .11 acre feet per growing season; salinity $\leq$ 2,250 micro mhos/cm; SAR $\leq$ 26.0 meq/L; alluvial valley floor absent. If all the attributes are found in either source of water, then irrigation is a recommended technique for establishing the high human use reclamation option under dry conditions. (Alluvium is removed for the high use option in TECON.)

C. OPUSE Subsystem

The environmental feasibility rankings from FEASI, and the economy cost per acre rankings from TECON are combined in OPUSE, for all five land uses. This program determines which of the five land uses has the best combination of high environmental feasibility, coupled with low reclamation cost, which equals the optimum land use. The other four land uses are also ranked in order using this method.

OPUSE is calculated by multiplying the FEASI ranking value x 1000, then dividing by the total reclamation cost for that same land use. OPUSE values will fall between 0 and 1 for the Northern Great Plains, with the highest ranking value being the most optimum use. This method places equal weight on the importance of feasibility and economy. The data analysis section of this manual shows an example of OPUSE output.

D. GRADE Subsystem

Detailed calculations of spoils grading volumes and costs was necessary in CLAIM because this constitutes a significant percentage of the total reclamation cost. Also, these GRADE routines can be adapted to a wide variety of other mine types. Since GRADE calculations are used throughout the reclamation analysis, the products of this system were described early in the data input section of this manual.

The CLAIM programmer's manual provides a detailed review, with diagrams, of the trigonometry used to calculate grading angles and volumes for both the dragline and truck and shovel type mines. In this section, some general diagrams are presented to familiarize the user with the overall grading concepts. The user also may wish to refer to Watts (1975) for an expanded discussion of these grading calculations.

Table 10. Multiple environmental factors from databook which require special reclamation techniques.

Databook Answer	Add or subtract from techniques master list (Table 6)									
	Cropland		Native Veg.		Wildlife		Water Recr.		High Use	
	Add	Subtract	Add	Subtract	Add	Subtract	Add	Subtract	Add	Subtract
1) I,A,1 and I,C,3	0[1]	0	--	--	--	--	--	--	--	--
2) III,A,1 or 2, or III,B,1 or III,C,1, 5 or 6 or III,F,3,4, or 5, or III,G,3 or 4 and [IV,A,4 and IV,B, 2,3, or 4, and IV,E,1 or 2, and IV,F,1 or 2]	b3,4	a1,2 b1,2	--	--	--	--	--	--	--	--
3) III,A,1 or III,B,1 or III,C,1,5 or 6 or III,F,3,4, or 5, or III,G,3 or 4, and [IV,A,1,2, or 3, or IV,B,1,5 or 6 or IV,E,3,4 or 5, or IV,F,3 or 4]	c2	a1,2 b1,2	--	--	--	--	--	--	--	--
4) III,A,1 or III,B,1 or III,C,1 or 6, or III,F,4 or 5, or III,G,3 or 4 and [IV,A,4 and IV,B,2,3,4 or 5, and IV,E,1,2,3 or 4 and IV,F,1,2 or 3]	--	--	b3,4	a1,2 b1,2	b3,4	a1,2 b1,2	b3,4	a1,2 b1,2	--	--

Table 10 Continued

Databook Answer	Add or subtract from techniques master list (Table 6)									
	Cropland		Native Veg.		Wildlife		Water Recr.		High Use	
	Add	Subtract	Add	Subtract	Add	Subtract	Add	Subtract	Add	Subtract
5) III,A,1 or III,B,1 or III,C,1 or 6 or III,F,4 or 5, or III,G,3 or 4 and [IV,A,1,2 or 3, or IV,B,1 or 6 or IV,E,5, or IV,F,4]	--	--	c2	a1,2 b1,2	c2	a1,2 b1,2	c2	a1,2 b1,2	--	--
6) III,A,1 or III,C,1 or 6, or III,F,5, or III,G,4, and [IV,B,2, 3,4, or 5, and IV,E,1, 2,3 or 4, and IV,F,1, 2 or 3]	--	--	--	--	--	--	--	--	b3,4	a1,2 b1,2
7) III,A,1 or III,C,1 or 6 or III,F,5, or III,G,4 and [IV,A,1, 2 or 3, or IV,B,1 or 6 or IV,E,5 or IV,F,4]	--	--	--	--	--	--	--	--	c2	a1,2 b1,2
8) II,A,1 or 2 and [[VI,B,3,4 or 5, and VI,E,1 or 2 and VI,F,1 or 2] or [VII,B,3,4, or 5 and VII,C,1 or 2, and VII,D,1 or 2]]	g3	--	--	--	--	--	--	--	--	--

Table 10 Continued

Databook Answer	Add or subtract from techniques master list (Table 6)									
	Cropland		Native Veg.		Wildlife		Water Recr.		High Use	
	Add	Subtract	Add	Subtract	Add	Subtract	Add	Subtract	Add	Subtract
9) II,A,1 and [[VI,B,2, 3,4 or 5, and VI,E,1, 2 or 3 and VI,F,1,2 or 3] or [VII,B,2,3, 4 or 5 and VII,C,1,2 or 3, and VII,D,1, 2 or 3]]	--	--	g3	--	g3	--	--	--	--	--
10) II,A,1 or 2 and [[VI, B,4 or 5, and VI,E,1,2 or 3] and VI,F,1 or 2] or [VII,B,4 or 5, and VII,C,1,2 or 3, and VII,D,1 or 2]]	--	--	--	--	--	--	g3	--	--	--
11) II,A,1 and [[VI,B,2, 3,4 or 5, and VI,E,1, 2 or 3, and VI,F,1,2 or 3] or [VII,B,2,3, 4 or 5, and VII,C,1, 2 or 3, and VII,D,1, 2 or 3, and VII,E, 2]]	--	--	--	--	--	--	--	--	g3	--

[1]A "0" means that land use is incompatible with the environmental condition, so is prohibited.

1. Dragline mines

Figure 164 shows a side view of the opening cut and mine run spoil banks. Material from each peak is pushed both ways to fill valleys on either side. The figure shows well that grading of opening cut spoils involves moving much more material to achieve a certain slope than does grading the mine run spoils.

In Figure 165, the final box cut pit is filled by grading. Large amounts of spoil must be pushed long distances to achieve anywhere near a gentle topography - when compared to the mine run spoils (both are shown graded to approximately 20 percent slopes).

In all cases, CLAIM calculates the grading costs per acre in terms of final disturbed acreage - not just the acres covered by the original raw spoils. For both the opening cut and final cut spoils, the acreage increases greatly as the final graded slopes approach one percent.

2. Truck and Shovel Mines

The logic behind this GRADE routine has been discussed extensively under the data input section of the manual. Figure 166 shows a cross section of these spoils, as produced by CLAIM. The spoil configuration is basically the same for all three stages in the mining sequence. The programmer's manual discusses the necessary calculations in detail.

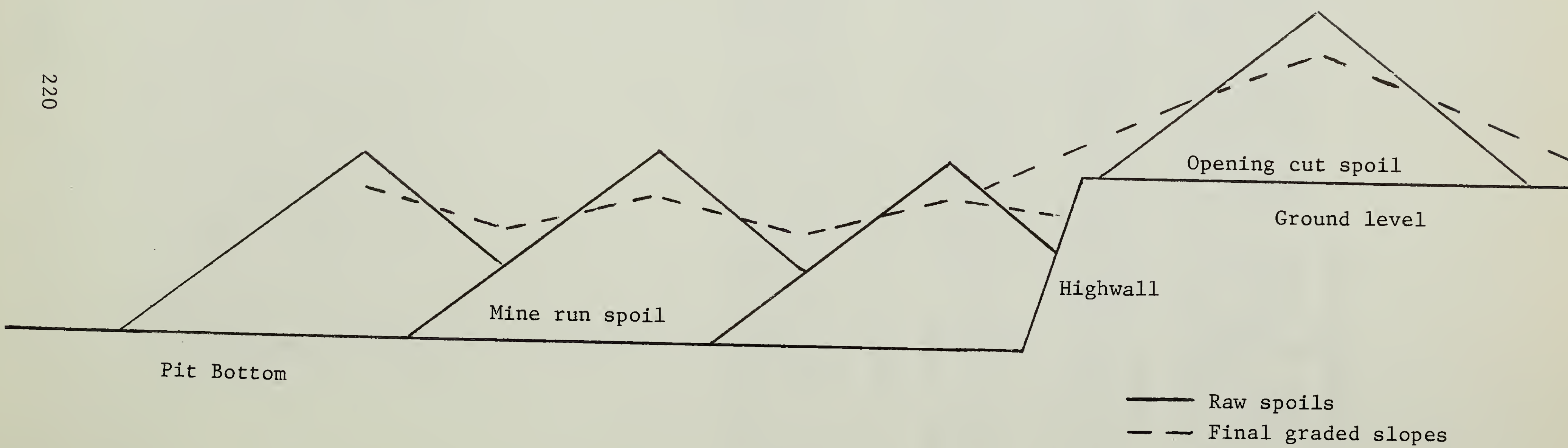


Figure 164. Diagram of GRADE scheme for opening cut and mine run spoils.

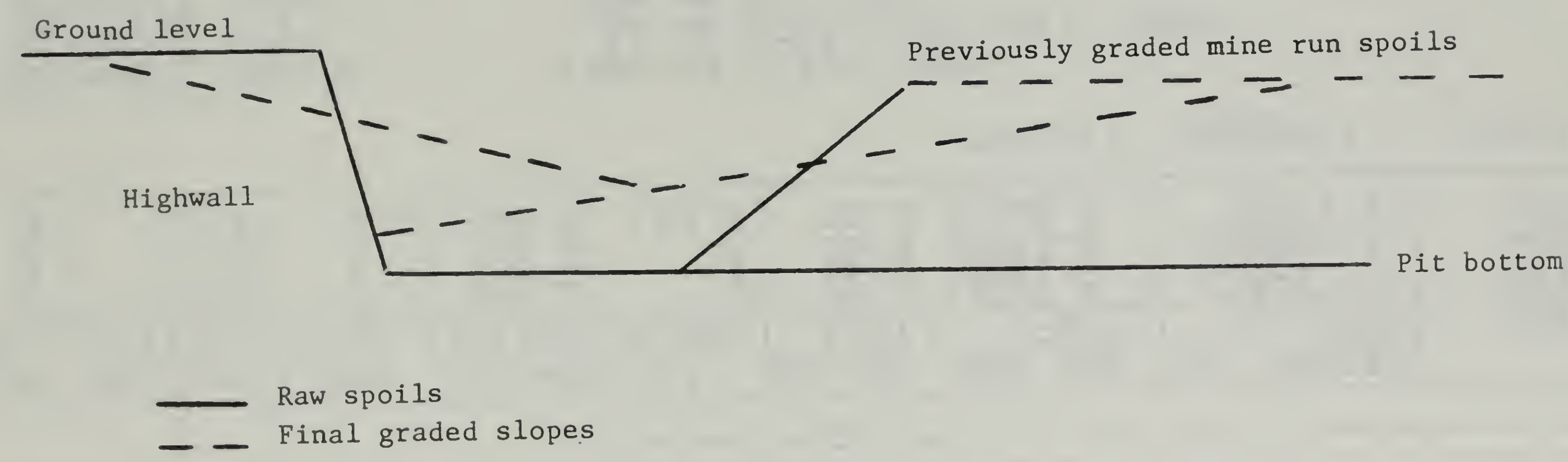
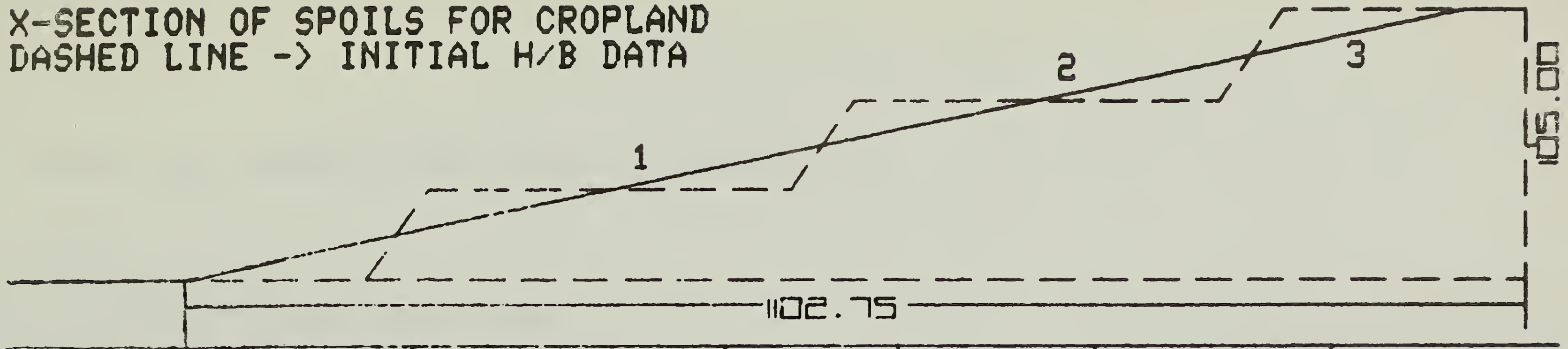


Figure 165. Diagram of GRADE scheme for final box cut.

X-SECTION OF SPOILS FOR CROPLAND
DASHED LINE -> INITIAL H/B DATA

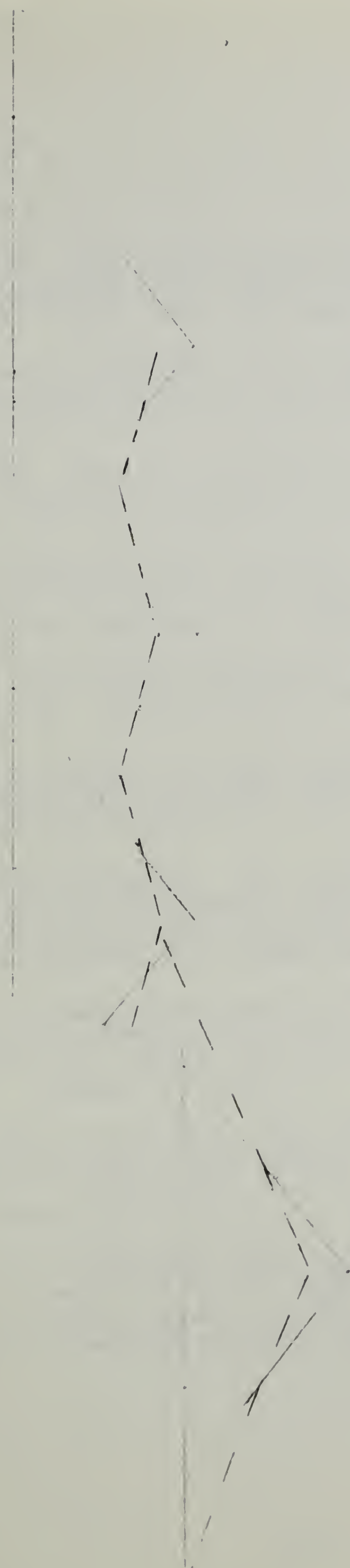


H/B NO.	HW SLOPES-DEG INITIAL:FINAL	BENCHES (FT) INITIAL:FINAL	HW HGT (FEET)	BEN LEN (FEET)	VOL GRADED (CU YDS)	COST
1	34.0: 5.7	298.8: .0	35.0	4507.2	133487.7	33371.93
2	34.0: 5.7	298.8: .0	35.0	2753.6	163980.5	40995.13
3	34.0: 5.7	200.0: 50.6	35.0	1000.0	79071.2	19767.79
				TOTALS:	376539.4	94134.86

REHANDLE VOLUME : 1000.00 CUBIC YARDS
REHANDLE COST : 50.00 CENTS PER CUBIC YARD
REHANDLE TOTAL : 500.00 DOLLARS

AREA COVERED BY GRADED SPOILS : 69.79 ACRES
REHANDLE COST PER ACRE : 7.16 DOLLARS
GRADING COST PER ACRE : 1348.78 DOLLARS
***** GRAND TOTAL COST PER ACRE IS 1355.94 DOLLARS *****
PLOTTER COPY ? (YES OR NO) ->NO

Figure 166. Cross sectional view of truck and shovel spoils grading scheme.



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